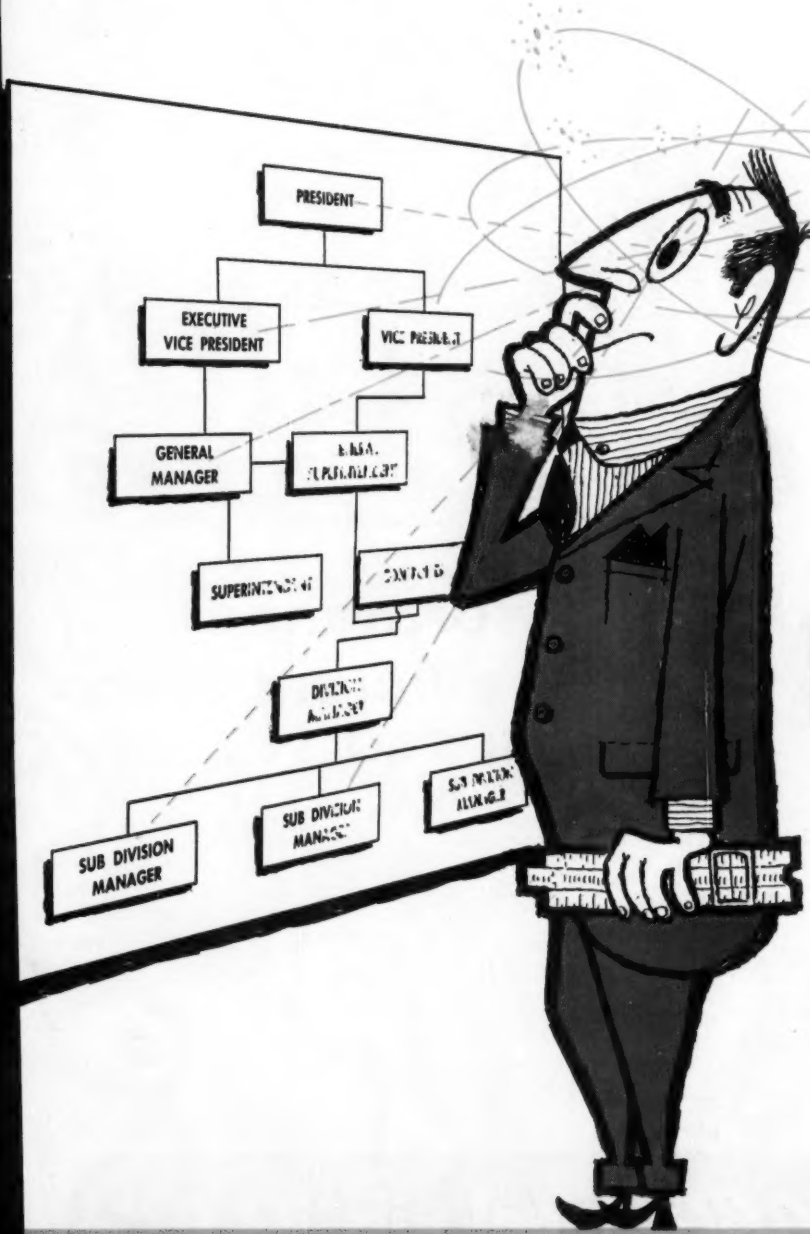
The Electrical Industry's Weekly Magazine

October 14, 1957

# Electrical World

Price 50 Cents

A McGraw-Hill Publication

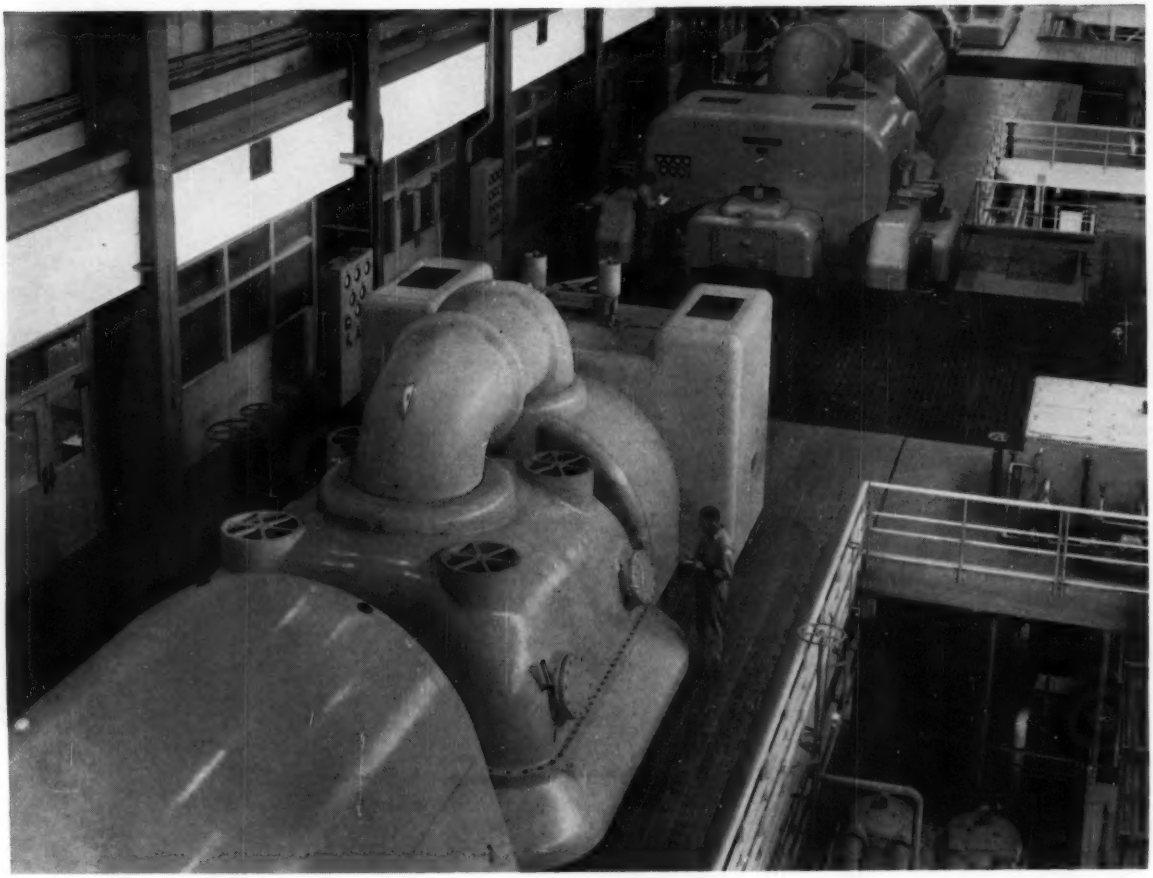



## Where Does the Engineer Stand?

...Page 80

## How Space Heat Affects Demand . . . Page 83

E B POWER
UNIVERSITY MICROFILMS
313 N 1 ST
ANN ARBOR



# To keep turbine performance at an efficient high

## Texaco Regal Oil R&O

Regardless of operating conditions, turbines lubricated with *Texaco Regal Oil R & O* can be depended upon to perform efficiently under peak and valley loads alike.

The reasons for the superiority of *Texaco Regal Oil R & O* over ordinary turbine oils are compelling:

- It prevents sludge, rust and foam, assures normal bearing temperatures and instantaneous governor response.
- It meets the exacting requirements of all leading turbine builders regardless of turbine type, size or special features.

With *Texaco Regal Oil R & O* you can count on extra-strong protection throughout an extra-long service life.

A Texaco Lubrication Engineer is trained to help you select the right turbine oil from Texaco's complete line of *Regal Oils R & O*. Just call the nearest of more than 2,000 Texaco Distributing Plants in the 48 States—or write The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO

**TEXACO Regal Oils R & O**

**FOR ALL TURBINES**

# Electrical World

Vol. 148, No. 16 October 14, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

## Features

CURRENT EVENTS

### Construction Progresses at U. S. Atom Plants

Various stages of building at Dresden, Indian Point, Enrico Fermi, and Shippingport are depicted.....p 74

DISTRIBUTION

### Demand Curves Aid T&D Design

Assist in accurate design of facilities for serving new load patterns created by growth of space heating.....p 83

GENERATION

### Pump-Storage Project Proves Out

North Wales project has capital cost advantage of 2 to 1 over thermal plant .....p 86

### Station Uses Proved Design Tenets

Yet new features are included in 80-Mw unit at Southwestern Public Service's Cunningham Station.....p 88

MANAGEMENT

### Where Does the Engineer Stand?

Survey of 86 utilities shows he performs his vital function at many organizational levels.....p 80

SUBSTATIONS

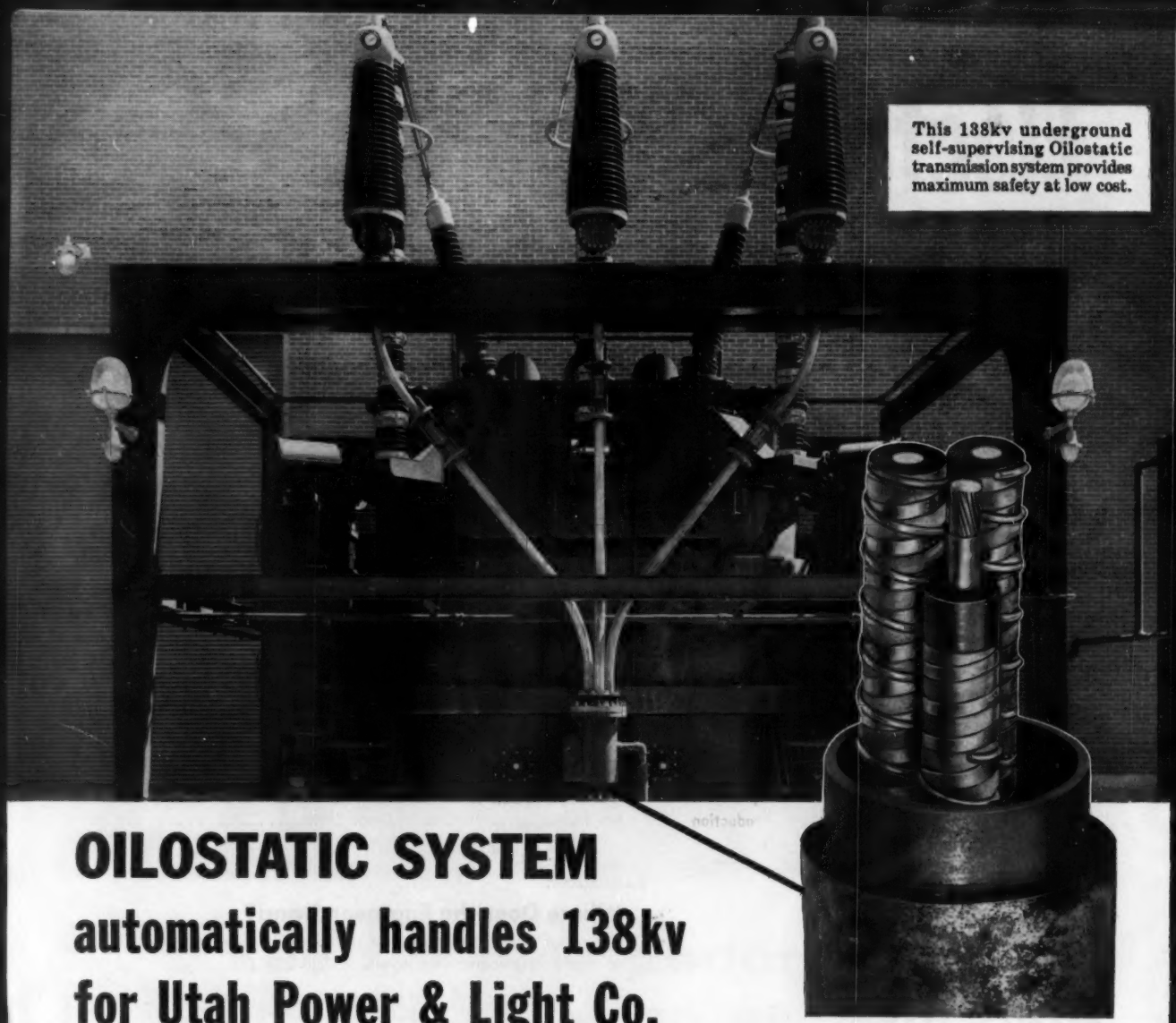
### These Decide Substation Lightning Protection

Adequacy and economy hinge on arrester location, line insulation level, line and station shielding.....p 90

## Departments

Atomic Progress ..... 74
Editorials ..... 73
• Electrical Newsletter ..... 19
Engineering Trends ..... 22
From the Publisher..... 5
Heating & Cooling.....108
How To ..... 97
• Management Newsletter .....133
Manufacturers and Markets.....141
Meetings ..... 78
Meetings Calendar .....150
New Equipment .....117
News About People.....146
News-Beat ..... 82
Selling .....104
Washington Wire ..... 76

INDEX TO ADVERTISERS.....155



This 138kv underground self-supervising Oilostatic transmission system provides maximum safety at low cost.

# OILOSTATIC SYSTEM automatically handles 138kv for Utah Power & Light Co.

Recently the **Utah Power & Light Co.** started operation of the third section of its new Gadsby steam-electric station to supply the growing power demands of the Intermountain West.

For the all-important high voltage transformer leads, an underground Okonite Oilostatic system was selected and installed by the **Bechtel Corporation.**

This system consists of paper-insulated cables installed in a welded steel pipe filled with oil maintained at 200 psi. The advantages of this type system are:

1. *Proved reliability, ruggedness and stability.*
2. *High normal and overload current carrying capacity.*
3. *Low initial cost compared to duct systems, plus space savings.*
4. *Low maintenance cost through self-supervision.*
5. *Ideal for high voltage transmission in congested areas.*
6. *Provides maximum safety.*

Proof that **Utah Power & Light** can expect to get outstanding performance from this installation is the fact that Okonite Oilostatic systems have been in successful operation since 1932.

For information on Oilostatic which has been installed to handle potentials as high as 230kv, write for BulletinEW-1044. Address:
**The Okonite Company, Passaic, New Jersey.**

3133-A

*available with either copper or aluminum conductors*

*where there's electrical power . . . there's* **OKONITE CABLE**

## Electrical World Staff

**Fischer Black** Publisher and Editor
**Daniel T Braymer** Assistant to the Editor

### Engineering

**Leonard M Olmsted** Managing Technical Editor
**John J Kearney** Assistant Managing Technical Editor
**Howard S Knowlton** New England Editor
**Edward Allen** Midwestern Editor
**Francis J Kovalcik** Middle Eastern Editor
**David Rea** Southeastern Editor
**James G Plunkett** Northeastern Editor
**Charles F Hochgesang** Western Editor
**Archer E Knowlton** Consulting Editor

### News

**Herbert R Frankel** Managing News Editor
**Rue M Shoop** Associate Editor
**Allen Long** News Editor **Michael G Duerr, Theodore Fuller** and **Denise Hennessy** Assistants
**Thomas R Jordan** Commercial Editor
**Kenneth N McLean** Industrial Editor
**George B Bryant, Jr** Manager, Washington Bureau
**V Craig Richter** Washington Correspondent

### Special Services

**Arthur J Stegeman** Manager, Market Research
**Dexter M Keezer** Director, Economics Department
**E Russell Eggers** Economist

### Production

**Jesse A Mock** Manager of Production
**George Swift** Assistant Manager of Production
**Frank C Stockman** Art Director
**H Tomlinson Howland, Jr** Production Editor
**Elinor Gulla** Assistant Production Editor

### Advertising

**Warren W Shaw** Sales Manager
**District Managers:** N V Palmer, E S Chapin and D J Roberts, New York; E S Chapin, Boston; F P Coyle, Philadelphia; M S Kearney, Cleveland; M I O'Connell, Detroit; W H Meneilley and J T Schaefer, Chicago; J T Schaefer, St. Louis; Russell Antles, Los Angeles; R C Alcorn and T H Carmody, San Francisco; Robert H Powell, Atlanta; Gordon Jones, Dallas.
**Otto A Drechsel** Business Manager
**Donald K Ellis** Promotion Manager

●

**E Bryson Sessions** Circulation Manager


## . . . from the publisher

# Hints to Save You Time

There's a knack to reading Electrical World. Its format is tailored to give you the most information in the least possible time. Following is the second of a series of tips we're running to help you take better advantage of our speed-read format.

**Tip No. 2—Read the articles about your own job.** Look for the tag at the beginning of each feature story. It will tell you the type of material it contains and the principle area of interest it covers—generation, transmission, etc. Next read the large headlines, subheads, and captions. These will give you a "feel" of the story, help you to outline in your mind the information to come. Then, "dig in." Refer to tables and charts freely. They are usually placed adjacent to the text material to which they refer.

Next, go to the regular weekly department that deals with your job—such as "How To" items, "Selling," "Management Newsletter." And while you're reading, consider the "why" of an idea or procedure—the need for it in the first place, its value. This will help you to decide whether the same idea can work for you.

Fischer Black


**ELECTRICAL WORLD**

Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), Founder. **Executive, Editorial, Circulation, and Advertising Offices:** McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed at 99-129 North Broadway, Albany 1, N. Y. See panel at right for directions regarding subscriptions or change of address.

Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice President; L. Keith Goodrich, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator.

Subscriptions are solicited from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields; and from consulting engineers and electrical engineers in industry. **Position and company connection must be indicated on subscription orders.** Send to address shown in box at right.

United States and Canada subscription rate for individuals in the field of the publication $6.00 per year, single copies 50 cents. Other Western Hemisphere and the Philippines $20.00 payable in advance and other countries $30.00 payable in advance.

Second-class mail privileges authorized at Albany, N. Y. Printed in U.S.A. Title registered in U.S. Patent Office.

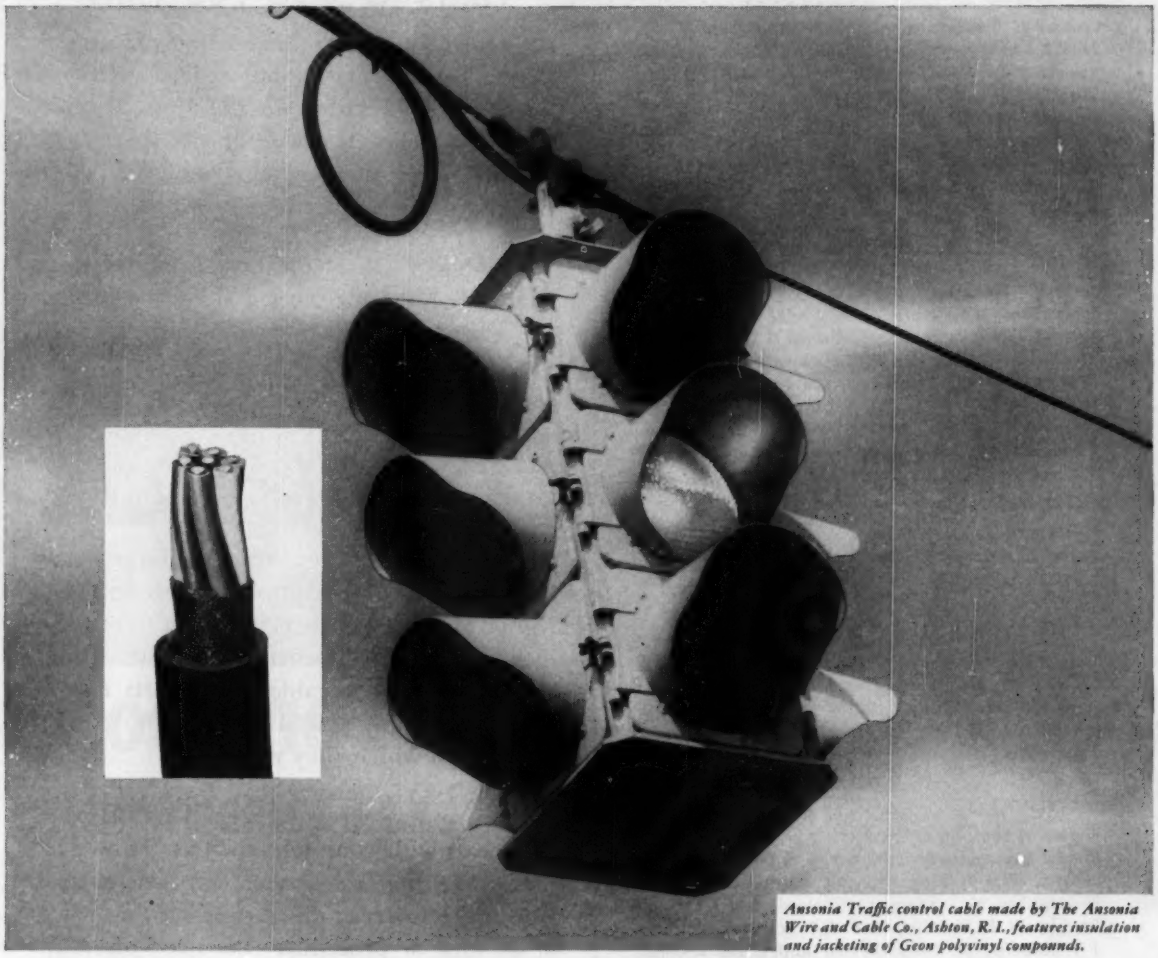
©Copyright 1957 McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.


SUBSCRIPTIONS AND ADDRESS CHANGES: Send subscription correspondence and change of address to Subscription Manager, ELECTRICAL WORLD, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Subscription Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

**Postmaster . . . Please send form 3579 to Electrical World, 330 W 42nd St., New York 36, N. Y.**

***Another new development using***

# B.F.Goodrich Chemical *raw materials*



*Ansonia Traffic control cable made by The Ansonia Wire and Cable Co., Ashton, R. I., features insulation and jacketing of Geon polyvinyl compounds.*

## cable with insulation of Geon helps tame traffic

THIS traffic cable with insulation and jacketing made of Geon polyvinyl materials has as many advantages as it does conductors. It is lightweight, easy to install and splice, has no braids to rot or wick moisture, no lead to corrode chemically, be eaten away by electrolysis or crystallize from vibration. It is resistant to oxygen, ozone, temperature changes and the sun's rays.

Insulation and jacketing compounds of Geon are strong, weatherproof and keep their exceptional properties with age. They resist flame, will not support combustion and have good flexing properties. Their resistance to oil, grease and air-borne acids, alkalies and other chemicals proves valuable in industrial areas.

On all *your* jobs, use the advantages of this outstanding cable and wire covering. For information, write Department GE-4, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

**B.F.Goodrich Chemical Company**
**a division of The B.F.Goodrich Company**

**B.F.Goodrich** GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

POWERS *American* PRESENTS . . .

an aerial unit designed specifically for operations requiring only one workman

THE COMPLETELY NEW

Series AB-1-41

# "Sky-Master"

HYDRAULIC AERIAL

FOR WORKING IN HARD-TO-REACH PLACES WITH GROUND-LEVEL EASE

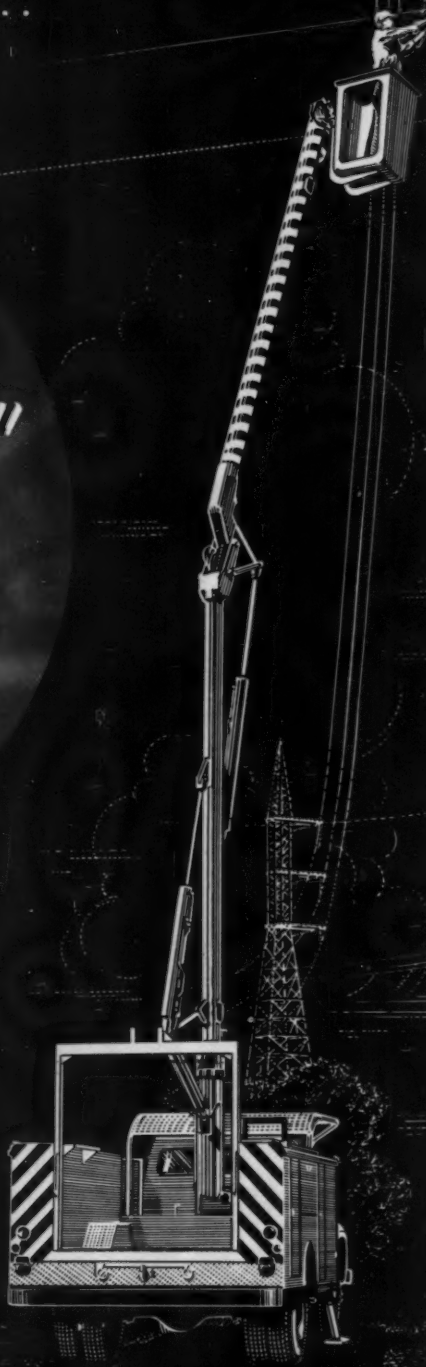
*Over • under • around obstacles* . . . Sky-Master quickly reaches out-of-the-way work — and provides on-the-ground safety and comfort for the workman.

Independently-operated steel beams are moved by double-acting hydraulic cylinders, through a unique system of linkage which greatly increases operating range. There are no chains, sprockets, or other secondary means of actuation. Supporting mast can be rotated *continuously* in either direction.

Work basket and insulated outer beam protects workman from 60,000 volts. Basket is automatically locked in position in event of damage to hydraulic lines.

The AB-1-41 . . . having ground-to-basket floor height of 41' . . . can be equipped for your particular job, and installed on a Powers-American Body that fits your needs.

*The heavy-duty Series AB-37 and AB-43 Sky-Master carries two men up, out, over, or down. Available in 37' and 43' ground-to-basket heights.*

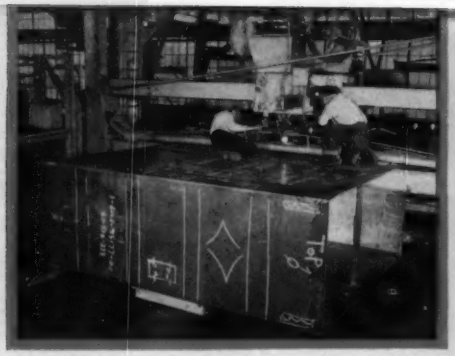


Descriptive literature on Series AB-1 and Series AB Sky-Master — with price information — will be sent on request.

## McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY • ST. LOUIS 15, MO. • 625 CEDAR ST. • BERKELEY 10, CALIF.

**...Attention to CONSTRUCTION detail adds years to transformer life... reduces maintenance**

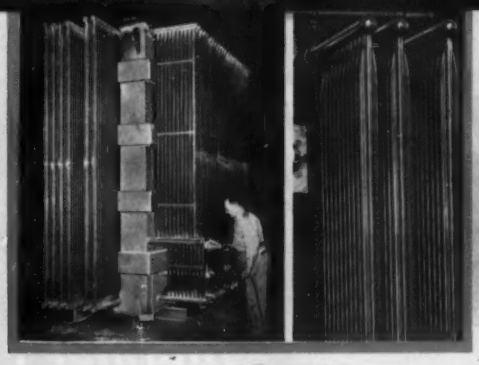


**Submerged arc welding** machine welds tank sections together in a smooth, liquid-tight seam. In other welding operations, giant "mechanical hands" position tank so arc welding is performed downhand for maximum strength. Size of fillets, exact locations, electrode and heat specifications are all determined by design engineers.

**ALLIS-CHALMERS** power transformers are

# weather

A-5316



**Welded-on radiators** save time and money by simplifying installation. After welding is completed, transformer is sealed and pressure tested under extreme conditions. Fewer parts reduce maintenance. Nooks and corners where dirt and corrosion get in their destructive licks are eliminated.

**Perfect seal** provided by gasketing method for bolted cover. Gasket seat is accurately formed to confine the cork Neoprene gasket and control its compression. Welded cover is also available. Domed cover sheds water, to lengthen life of protective paint.

# -tight

## Balanced Design means

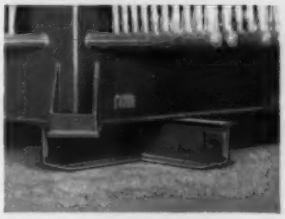
## MORE for your Transformer Dollar

Weather-tight construction is another of the many features that make up the balanced design of Allis-Chalmers power transformers . . . features such as corona-free design, high impulse strength, uniform cooling, high short-circuit strength, reduced size and weight and many, many other features.

With power demands continually increasing, it is more important than ever to get assurance of dependability and long transformer life. For all the facts, call your nearby Allis-Chalmers office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

# ALLIS-CHALMERS

## Check these conveniences too!

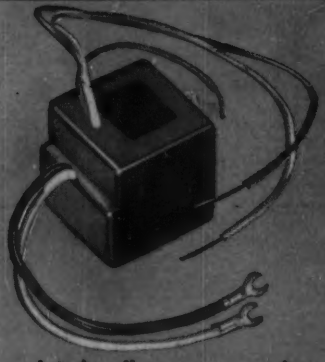


**Ample jacking space** makes installation quick and easy. Practically any type jack may be used.

**Ski-shaped base** of heavy I-beam cross supports makes it possible to skid transformer in any direction.

# LOOK TO SANGAMO FOR DEMAND

*thermal . . .*



**Encapsulated coil assures maximum protection from lightning and high voltage surges.** The potential transformer coil of the demand element is encapsulated in a specially developed epoxy resin with extremely high dielectric strength. Thus, the insulation levels of the demand element and the watthour meter element in these combination meters are equally high.

## LINCOLN DEMAND METERS

Lincoln J2T thermal-demand watthour meters combine ± 2% full scale accuracy with exceptionally trouble-free performance to provide long life, low-cost demand measurement. Only two operating adjustments are necessary.

The J2T is ideally suited for application to singlephase residential and commercial loads. It is supplied with scale values of 12 KW, 24 KW, and 48 KW to take full advantage of the capacity of J2 Watthour Meters. A 12/24 KW or 24/48 KW scale is available for growing loads.

Other Lincoln Meters are available for polyphase demand measurement. Send coupon at left for complete technical information on Lincoln Meters and how they fit every application for billing measurement—singlephase or polyphase.

SANGAMO ELECTRIC COMPANY, Springfield, Illinois.

Please send complete information on Lincoln Thermal Demand Meters.

Name_____

Company_____

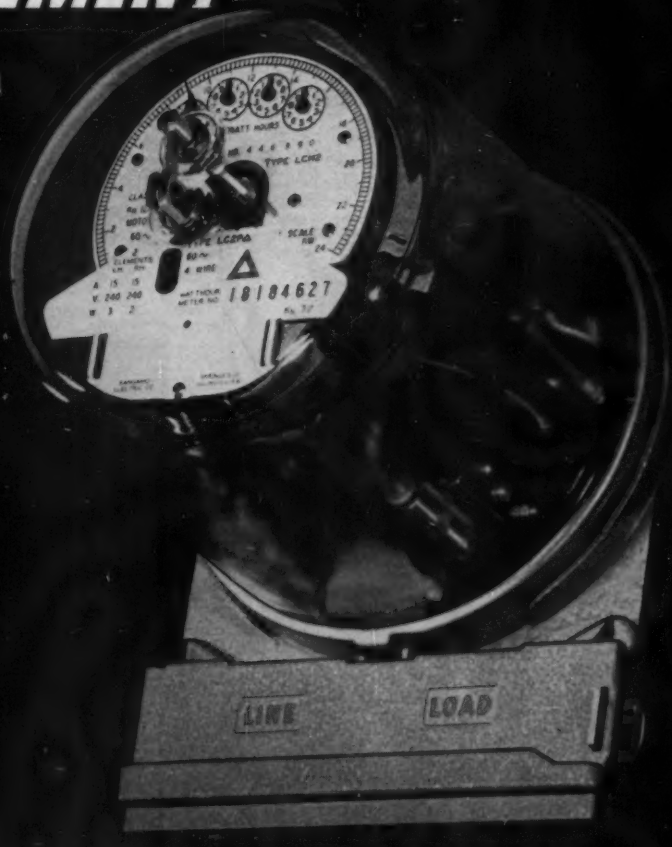
Address_____

City_____ State_____

## SANGAMO ELECTRIC

# MEASUREMENT

. mechanical

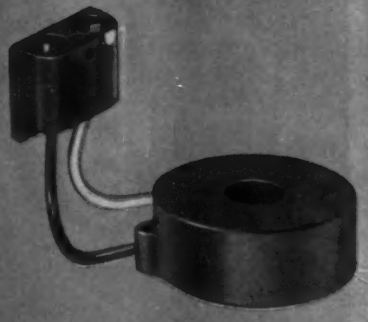



# SANGAMO DEMAND REGISTERS

Sangamo Mechanical Demand Registers, both singlephase and polyphase, are built to give many years of dependable service within the guaranteed accuracy limits of ± 2% full scale. Only two adjustments, zero setting and idle pointer friction, are required.

The long service life of these demand registers is due to: 1. The Sangamo slow-speed, high torque motor; 2. The timing gear shafts with hardened, polished *stainless steel* pivots which turn in lifetime-lubricated porous bronze bearings; 3. The use of jeweled and nylon thrust bearings; 4. The dependable, clutch-free, gravity reset mechanism.

Both the JH2 (Singlephase) and LCH2 (Polyphase) registers can be field-installed on any modern Sangamo Watthour Meter without recalibration. Send the coupon at right for complete information on Sangamo Mechanical Demand Registers.



**The heart of the Demand Register is the *timing motor*.** The motor coil of the Sangamo Type H Motor is encapsulated in a specially developed epoxy resin with voltage breakdown in excess of 10,000 volts. The motor operates at slow speed, only 450 rpm. Special silicone grease packing permits stable operation from −50° to 250° F.

**COMPANY** *Springfield, Illinois*

SANGAMO ELECTRIC COMPANY, Springfield, Illinois.

Please send complete information on Sangamo Demand Registers.

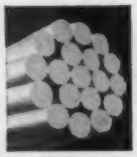
Name_____

Company_____

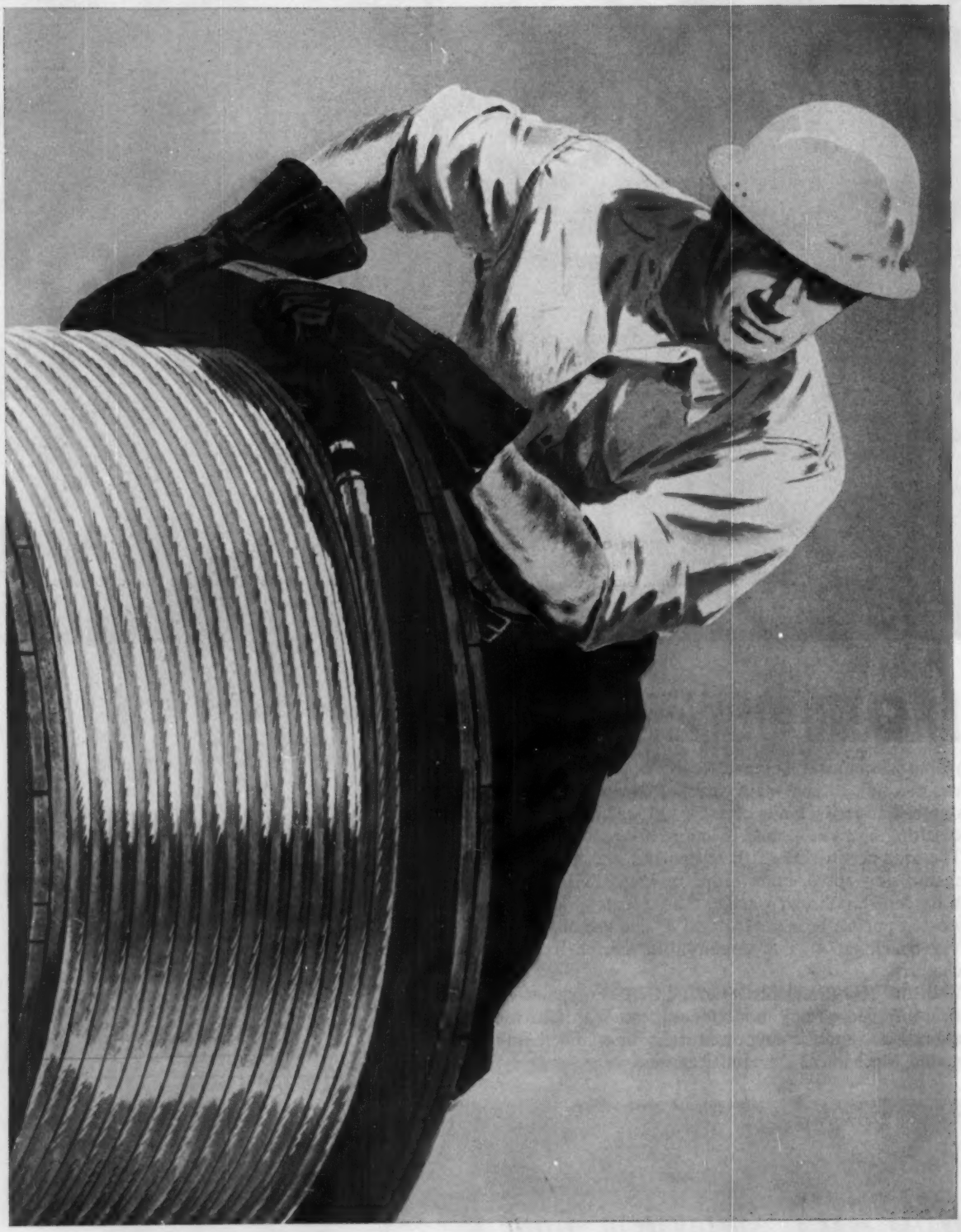
Address_____

City_____ State_____

SM57-3



***IF IT CARRIES CURRENT, K&W CARRIES IT!***



# AAAC*—A COMPARISON WITH ACSR, ALL-ALUMINUM AND COPPER CONDUCTORS

*"The initials AAAC are not a trade-mark of Kaiser Aluminum, but are regarded as a grade designation for All Aluminum Alloy Conductor (developed by Kaiser Aluminum). The initials are intended to be used freely throughout the industry in designating such products, as is the case with grade designation ACSR, Aluminum Conductor, Steel Reinforced. Since heat treatment and processing are critical, Kaiser Aluminum will sell carefully controlled wire on process reels to other fabricators for stranding and for covering. This will be done at a later date when testing is completed.

**WHAT IS AAAC?**

AAAC is a high-strength, high-electrical conductivity heat-treatable aluminum-magnesium-silicon alloy developed by Kaiser Aluminum. Through the combination of proper heat treatment and cold reduction, wire is produced having exceptional mechanical strength yet with electrical conductivity only moderately reduced from that of pure E.C. aluminum.

**HOW DOES AAAC COMPARE IN EFFICIENCY?**

$$\frac{\text{Tensile Strength} \times \text{Conductivity}}{\text{Specific Gravity}}$$

The above formula may be looked upon as a rough criterion for conductor metal efficiency in high-tensioned overhead line construction. Using this efficiency criterion, AAAC is:

1. 40% more efficient than hard-drawn copper
2. Almost twice as efficient as E.C. aluminum
3. 35% more efficient than ACSR.

**HOW DOES AAAC INSTALLATION COMPARE?**

AAAC is as simple to splice and dead-end as all aluminum or copper cables. For splicing, only a single compression sleeve is required. This eliminates the separate steel sleeve, and the cutting back of strands necessary when splicing ACSR. Automatic or preformed splices can develop the full strength of the conductor without special preparation. For dead-ending, suitable bolted-type clamps can develop the full conductor strength. All this means that in many cases fittings will be less costly than those for ACSR, installation time will be less, and rapid emergency repairs may be made more quickly even when the line must remain energized during repair. Armor rods used on ACSR can also be used satisfactorily on AAAC. Repair sleeves, armor rods, clips and other non-tension accessories are interchangeable due to same physical sizes.

**WHAT ABOUT SIZES?**

AAAC is designed in sizes to have the same DC resistance as equivalent ACSR conductors. (Diameter and breaking strength are approximately equal.)

**WHAT IS CORROSION RESISTANCE OF AAAC?**

AAAC is mono-metallic and the alloy has great inherent corrosion resistance. Galvanic corrosion, which may sometimes occur between the steel core wires and adjacent aluminum strands in an ACSR conductor in severe environments, cannot take place with AAAC.

**WHAT ABOUT THE OPERATING COST OF AAAC?**

For the same current carried AAAC will operate cooler than ACSR with a cost-saving and lower watt loss per foot of conductor. Both AC resistance and inductive reactance of AAAC at one foot spacings is approximately 10% lower than the equivalent ACSR in the normal distribution sizes and, for a given length, will have less voltage drop.

**HOW DURABLE IS AAAC?**

AAAC has about twice the Brinell hardness of hard-drawn E.C. aluminum. It will, therefore, not abrade as readily as all-aluminum or ACSR conductors during installation nor will it wear to the same extent in ties, dead-ends and clamps.

**HOW DOES AAAC COMPARE IN TENSILE STRENGTH?**

Since AAAC has the same metal area as ACSR and has the same average unit strength, the conductor strength will be the same as its ACSR equivalent.

**WHAT ABOUT EXTRA HIGH VOLTAGE?**

Kaiser Aluminum is currently cooperating with leading universities in the study of extra-high voltage applications of *both* AAAC and ACSR . . . in actual installations, in experimental lines and in laboratory investigations. Extensive preliminary experimental installations are now being evaluated.

**As an industry leader in this increasingly important extra high voltage field—and as a leading supplier of both AAAC and ACSR—KW can give you unsurpassed service in any transmission problem.**

For further information on these KW developments, or for immediate service on any wiring need, contact the Kaiser Aluminum sales office or the KW distributor listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc., *Executive Office*, Kaiser Bldg., Oakland 12, California; *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois.

**Kaiser Aluminum**

***IF IT CARRIES CURRENT, K/W CARRIES IT!***

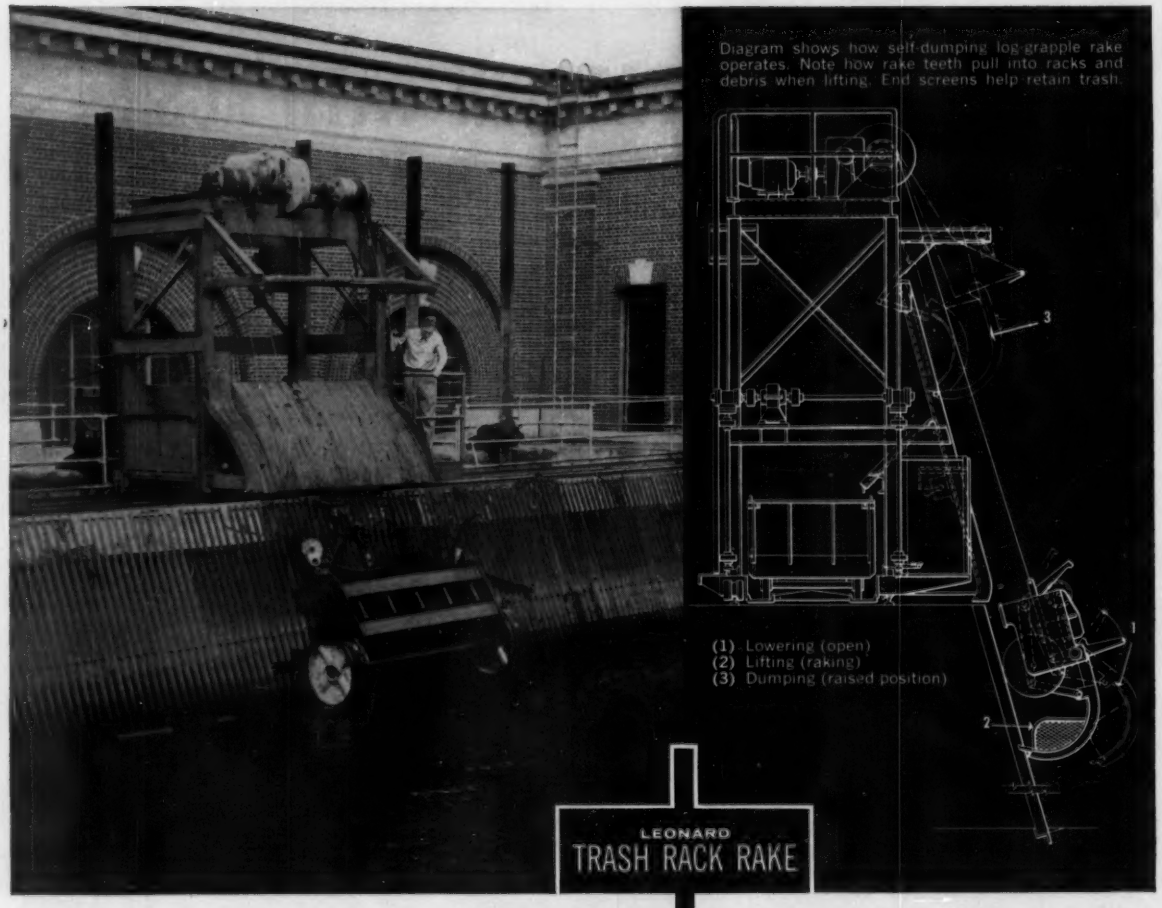


Diagram shows how self-dumping log-grapple rake operates. Note how rake teeth pull into racks and debris when lifting. End screens help retain trash.
(1) Lowering (open)
(2) Lifting (raking)
(3) Dumping (raised position)
1
2
3
LEONARD
TRASH RACK RAKE

New 8-foot, self-dumping SMS rake at Niagara Mohawk Power Corporation's Black River Station is one of five recently installed by this company.

# Two New Self-Dumping SMS Trash Rake Designs CUT CLEANING TIME AND LABOR

Now SMS offers you two improved Leonard trash rack rakes, both regular and log-grapple types. These self-dumping rake designs make operation easier and quicker, permit you to clean a greater area faster. Both new rake types are now available as additions to the SMS line of standard rake designs.

SMS Leonard rakes operate directly on trash rack bars . . . ride down over stubborn obstructions and work them loose. Such freedom of movement assures fast, easy cleaning. Initial costs are low because the width of SMS rakes can be kept to the minimum required for handling for trash and the expense of guides attached to racks, or embedded in piers is eliminated. These rakes are of simple and rugged construction, designed for outdoor service and require minimum maintenance.

For full information on trash rakes and other SMS accessories, write to S. Morgan Smith Co., York, Penna. Request Bulletin 158 on Leonard rakes, or Bulletin 158A on new, self-dumping rakes.

SMS

**S. MORGAN SMITH** HYDRODYNAMICS

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

Rotovalves • Ball Valves • R-S Butterfly Valves • Free-Discharge Valves • Liquid Heaters • Pumps • Hydraulic Turbines & Accessories

# R T & E Speeds Voltage Changeover for California Electric Power Company

Mr. W. B. Loper, C.E.P. Chief Engineer, inspecting RT & E Units at Woodcrest Substation, East of Riverside, California, near March Air Force Base

IMPULSE TESTED

**R T & E CORPORATION**
**Waukesha, Wisconsin**

*Equipment to help provide power for America*

**California Electric Power Company faced the problem of making a rapid cutover . . . in areas served from distribution circuits of 2400, 4160, and 4800 volts delta and wye . . . to 12,000 volts.**

**Mr. W. B. Loper, Chief Engineer of California Electric Power, found after careful study that these cutovers could be made faster and more economically if special 100 KVA transformers were available.**

**The problem was presented to the R T & E Engineering Department, where swift and careful attention to the problem resulted in a specially designed transformer capable of transforming all three voltages to the 12 KV level.**

**These special units were manufactured and delivered in record time to meet an emergency condition, saving the utility time and money. Electrical characteristics proved to be excellent, and cutovers were made on schedule.**

***This type of special service is another reason why R T & E Transformers are being specified by more and more utilities the nation over.***

*Helping the industry meet its growing loads*

# *Westinghouse Pioneers cost-saving unit for Bergen Generating Station*

ELECTRIC UTILITY EXECUTIVES are taking a thoughtful look at the lower capital cost and long-range savings brought about by a new 290-mw Westinghouse cross-compound turbine-generator. Pioneered in conjunction with the Public Service Electric and Gas Company, *two* of these Westinghouse units will soon be installed in the Bergen (N. J.) Generating Station.

The double 3600-rpm cross-compound arrangement, developed for this installation, allows a degree of standardization of components talked of but never before realized in the race to larger and larger machines.

Lower capital and operating costs will be realized by the unusual arrangement of the components. For example, *duplicate* generators and *duplicate* switchgear are used because the load is split evenly between the 3600-rpm shafts. About $500,000 is saved in this plant's first cost, through the unique method of powering the boiler feed pumps by the generator shafts.

Station costs will be lower because the time-proven components in this new machine are lighter and smaller than in other cross-compound turbine-generators.

This new Westinghouse concept for a large turbine-generator clearly demonstrates that Westinghouse continues searching for . . . and succeeds in discovering . . . new and more economical designs to help the industry meet its growing loads. J-97214

Model of one of the two Westinghouse 290-mw turbine-generators designed for the Bergen Generating Station. Unusual feature: boiler feed pumps are driven by the shafts of the duplicate generators. L to R: W. C. Wood, Westinghouse Newark District Manager with J. R. Carlson, Manager of Engineering, Westinghouse Steam Division, South Philadelphia Works.

### *Five other utilities order this new turbine-generator*

Since the original order from Public Service Electric and Gas Company, the following utilities have ordered turbine-generators similar in design to the new Bergen machine: Alabama Power Company, Consumers Power Company, Pacific Gas & Electric Company, Pennsylvania Power & Light Company and Southern California Edison Company.

### *Highlights of new Bergen design*

- Two equally rated 3600-rpm generators
- Boiler feed pumps powered by the main generator shafts
- Small tried and proven components

These are the features of the new 290-mw cross-compound, quadruple flow, reheat turbine-generator which will use an inlet steam pressure of 2350 psig, and initial temperature of 1100 F with one reheat to 1050 F.

### *Fewer spare parts*

The equal load split between the two 3600-rpm shafts results in *duplicate* generators and *duplicate* switchgear. The LP turbine elements are also *duplicates*. Because so many parts are common, fewer need to be stocked for spares.

### *About $500,000 saved in this plant's first cost*

. . . for the two machines soon to be installed in the Bergen Generating Station. Through an unusual arrangement, the boiler feed pumps are driven by the generator shafts, eliminating the need for motors and control for these pumps. This arrangement, of course, also cuts requirements for auxiliary electric power.

### *Time-proven components*

The use of conventional Westinghouse components in these large turbine-generators assures continued high level efficiency.

### *Lighter foundations, less space . . .*

. . . less crane capacity and headroom and lower shipping and handling costs. The two high-speed shafts permit the use of smaller and lighter components than are used in conventional 3600/1800-rpm cross-compound machine.

YOU CAN BE SURE...IF IT'S

Westinghouse

# here's a fuse link that clears faults itself

## especially needed for high interrupting capacity cutouts at 12 kv and above

In years past, distribution at 4 kv and below was the rule, and the faults were low. The interruption of short-circuit current was relatively easy, not only because the circuit voltage was low but because the maximum duty imposed on a distribution cutout was low enough to permit the use of small bore fuse tubes. And these small bore tubes gave fairly sure circuit interruption over the entire fault current range.

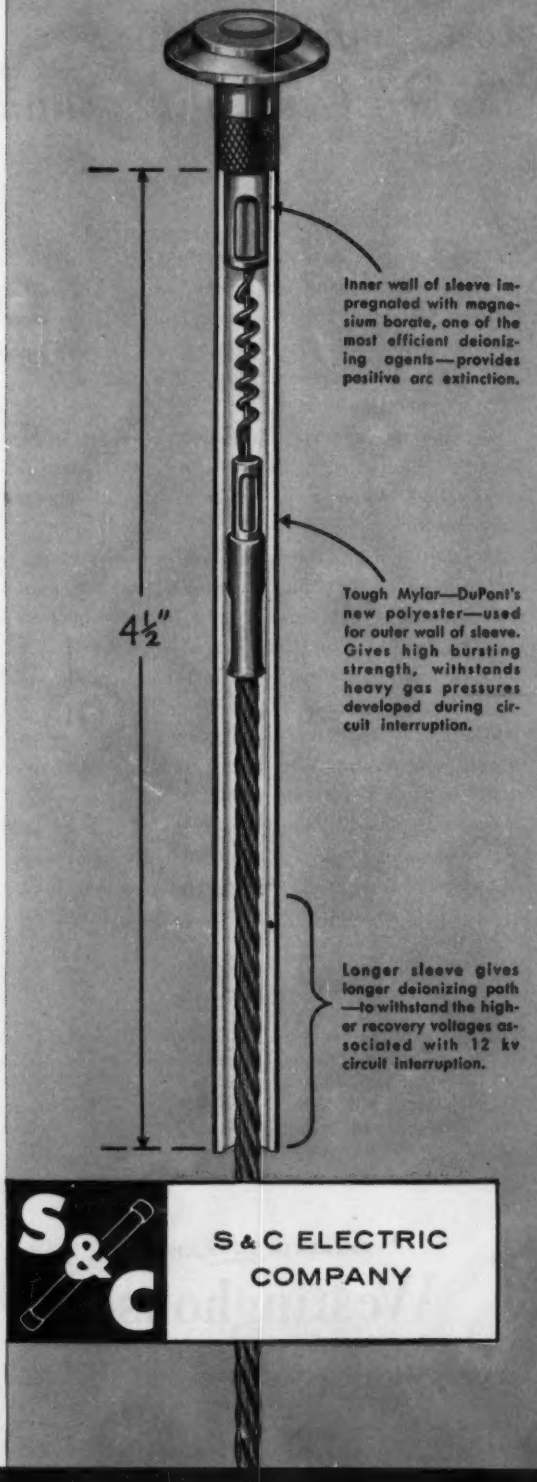
Today, circuit interruption is a lot tougher. Because of the high short-circuit currents, cutout manufacturers have increased, or should increase, the fuse tube bore diameter to minimize blast violence and to retain single-vented operation with its inherently safer *exhaust* behavior. And yet, when fused with conventional fuse links, such large bore cutouts can't reliably interrupt low-to-medium faults.

The result has been that the user has had to choose between: (1) A large bore cutout that couldn't positively clear the lower faults, hence requiring a momentary feeder outage by putting this duty on the back-up recloser and breaker while the cutout dropped open to isolate the fault, or (2) a small bore double-vented cutout that is inherently dangerous.

This new S&C Positrol Fuse Link makes the choice easy and obvious. By itself—and regardless of cutout design—it gives positive interruption of low and intermediate faults. With fault currents of 800 amperes and lower, this S&C Fuse Link acts positively as a dependable interrupting device at 12 kv. The illustration shows why.

Of course, at higher faults, the cutout takes over the interrupting duty.

S&C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ont.


4½"
Inner wall of sleeve impregnated with magnesium borate, one of the most efficient deionizing agents—provides positive arc extinction.
Tough Mylar—DuPont's new polyester—used for outer wall of sleeve. Gives high bursting strength, withstands heavy gas pressures developed during circuit interruption.
Longer sleeve gives longer deionizing path—to withstand the higher recovery voltages associated with 12 kv circuit interruption.
S&C
S&C ELECTRIC COMPANY

# NEWS-SCOPE

**FUTURE NEWS** ▶ **The need for scientists and engineers** for privately-supported atomic energy activities will more than double in the next three years, predicts a survey made for AEC by Atomic Industrial Forum.

**National Electric Week committee will seek to find a strong** "news hook" to focus nationwide attention on the observance next February 9-15. In the past, NEW has been largely a local affair.

**LATE NEWS** ▶ **Continued rising costs of nuclear power reactors** leads AEC to cancel contract negotiations for two proposed facilities. First cancellation involved a 10,000-kw aqueous homogeneous reactor Foster Wheeler was to build for Wolverine Electric Co-op in Michigan. Cost rose from $5.5 million to $14.4 million. Second was with American Machine & Foundry for a 22,000-kw boiling water reactor for Rural Co-op Power Assn of Elk River, Minn. AMF sought to boost the price from $8.9 to $11.8 million.

**Yankee Atomic Electric is virtually assured of being granted a** construction permit by AEC to build a $57-million nuclear power plant at Rowe, Mass. Proposal to issue permit went uncontested at last week's public hearings. And AEC Hazards Evaluation Office supported findings of Reactor Safeguards Committee that there was no undue risk to public safety in building the plant at Rowe.

**Georgia Power and City of Atlanta join forces** in unusual million-dollar plan to increase the area's power and water supply and to help solve Atlanta's problem of pollution from sewage. Each will finance half the cost of building an addition to Georgia Power's dam at Morgan Falls reservoir. The utility will remain sole owner.

**NEMA announces formation of new Pole Line Hardware Section** which will take the place of the Line Hardware Institute, discontinued Sept. 30. The new section, which comprises eight member companies, is headed by A. R. Waehner, Line Material Industries.

**AEC announces plans to operate a reactor entirely on plutonium fuel** in the near future. The Materials Testing Reactor at Arco, Idaho, has been chosen to be the first large reactor so fueled.

**Opening of bids for building the Niagara power plant is postponed** until Nov. 14 by New York Power Authority. NYPA spokesman said the action is due to NYPA's inability to arrange for necessary financing until its current dispute with local residents is settled.

**Southeastern Power Administration and Georgia Power sign** 10-year pact covering wheeling arrangements for 141 Mw to be produced at the Buford, Allatoona, and Clark Hill projects.

**Congratulations . . . Vermont Electric Power elects Byron O. McCoy** as vice president-operations . . . Lawrence G. Maechtlen becomes first vice president of Square D Co.

# ELECTRICAL WEEK

**A TWO-MINUTE**

**ATOMIC PROGRESS** ▶ **Southwest Atomic Energy Associates offers a contract** for study of an epithermal breeder reactor **(p 82)** . . . Nuclear core for Shippingport's pressurized water reactor is installed **(p 74).**

**EVENTS** ▶ **Cost of nuclear power plants will drop 50% in the next eight years,** predicts O. B. Falls Jr, of General Electric. Furthermore, fuel costs will fall 35%, he tells SEE group **(p 78)** . . . Iowa-Illinois G&E sets up panels on cost-of-capital, investors' views of common stock, plant investment, and financing plans to broaden its managers' understanding of utility financial matters **(p 77)** . . . Federal Power Commission hearing on N. Y. State Power Authority's license for Niagara project drags, produces conflicting testimony **(p 76).**

**GENERATION** ▶ **Interest in pumped storage continues to gather momentum** as Britain's Central Electricity Authority plans a 300-Mw power station in North Wales. Two concrete buttress dams must be built: A 90-ft dam at the lake supply, and a 30-ft dam for the lower reservoir. Despite this, the project will cost half as much as an equivalent thermal plant, will be depreciated over its longer life, will prove economical in the light of power-produced vs. power consumed, will cost less to operate and maintain, and will cut thermal plant standby losses **(p 86).**

**Use of "leather-finished" aluminum for outside walls** and ceramic-coated aluminum trimming are two innovations being tried at Southwestern Public Service Co's Cunningham Station. Object: To eliminate exterior painting, which would pay for the extra cost in five years. Other features: The turbine room is equipped with an acoustical ceiling made of fibrous glass and perforated metal to cut high noise levels 20%. In time the utility hopes to learn whether it pays to use treated lumber in cooling towers; half of Cunningham's tower wood is treated and half isn't **(p 88).**

**DISTRIBUTION** ▶ **Better regulation on long unregulated 23/13.2-kv distribution lines** is afforded by 23-kv capacitor installations on poles. The capacitors are switched automatically by voltage control or timers which operate 15-kv oil switches in lines from capacitors to ground. Carolina P&L endorses this practice after two years' successful operating experience **(p 100).**

**A graph-paper portrait of the electric living habits** of many families discloses two things: (1) That space heating load invariably peaks between 6 and 11 AM, and (2) The lighting-and-appliance load peaks about 6 PM. The cumulative peak for a group of houses will occur in the morning until space heating saturation hits 30%. Then the big peak hits in the evening. Knowing these facts, understanding the techniques described in the article and using the accompanying graphs, you can work out better designs for transmission and distribution systems serving these fast-growing residential loads **(p 83).**

## PREVIEW OF THIS WEEK'S ELECTRICAL WORLD

**SUBSTATIONS** ▶ **Protecting substations properly from lightning** depends upon four things: Adequate facilities, arrester location, line insulation level, and line and station shielding. The author tells how to cope with direct strokes on the substation, explains crest values and traveling wave shapes carried by transmission lines, calculates surge voltage for an "over simplified" sub having two circuits, and discusses arrester placement (p 90).

**ORGANIZATION** ▶ **How does the engineer fit into utility management teams?** The top engineer is a vice president in 82% of large companies, 62% of middle-sized companies, and 50% of small companies. Otherwise he's most likely called "chief engineer." In most large companies, the top engineer reports to the president. In other cases, he may report to vice presidents. After surveying 86 utilities, author George Peak concludes that efficient organization cannot be reduced to a formula, but must be designed to meet individual company needs (p 80).

**SELLING** ▶ **Florida flower farmers are harvesting bigger, better crops** by combining the state's mild climate with electric light at night to extend the growing period for pom-poms and gladioli (p 104).

**INDUSTRIAL** ▶ **Electrically heated machines bend fiberboard and plywood** into tubes and other tricky shapes for a midwestern manufacturer. They produce uniformly good results (p 112).

**FINANCIAL** ▶ **Give the investor more of what he wants**—appreciation potential. Most important factor is prospective improvement in per-share earnings (p 135).

**PEOPLE** ▶ **Potomac Electric Power has named** Dorsey F. Hughes vice-president and electrical engineer; George C. McCabe v-p and manager of the electric system; Lewis W. Cadwallader v-p and mechanical engineer; and Charles L. Carr v-p and controller . . . General Electric Co has advanced Robert Paxton to executive v-p of operations; Arthur F. Vinson to v-p and group-executive of the apparatus group; James H. Goss to v-p and group executive of consumer products group; and Halbert B. Miller to v-p of manufacturing services (p 146).

**NEW EQUIPMENT** ▶ **AC network analyzer simulates power transmission systems** on a desk top, solving problems too big for hand calculation but too small for a large analyzer . . . Non-segregated phase buses now available for 4.16, 7.2, and 13.8 kv duty (p 117).

**MANUFACTURERS** ▶ **Small, lightweight lightning arresters** are being used on 345-kv . . . Order let for thirteen 167-Mva waterwheel generators for Niagara project . . . Automatic circuit recloser for 46-kv-maximum service to be marketed soon (p 141).

# ENGINEERING TRENDS

**Doubly-oriented magnetic sheet material has been developed** to increase efficiency of transformers, motors, and generators. Made of silicon iron it can be magnetized easily in four directions.

**Electric furnace steel-making costs have been lowered** by improved furnace design and operation to a point where this process is almost competitive with open hearth furnaces in the production of low-carbon steel. This situation may become more favorable as open-hearth operations become more expensive with the depletion of fossil fuels supplies. Electricity will not remain as dependent on fossil fuels with the coming use of nuclear energy.

**Automation in the petroleum industry could lead the way** for new automatic controls in power plants. Refineries of the future will probably have automatic digital computers redesigned to send control signals from precalculated programming tape, sensing devices to adjust speed of production, and automatic monitoring of product analysis.

**Heat output of natural-uranium, gas-cooled reactor is increased by 50%** by increasing the enrichment of natural uranium by 10%—or to about 0.79%. Output would be nearly doubled by increasing the enrichment another 10%.

**Remotely operated welding unit is used to seal highly radioactive material** in stainless steel capsules at Oak Ridge National Laboratory. The unit uses an inert gas shielded arc welding torch. The remotely-operated portion of the welding device, which is placed in a shield cell equipped with mechanical manipulators, consists of a two-piece stainless steel frame, and motor-driven positioner for both the torch and containers.

**Structure costs of transmission crossing swamps** and other completely inaccessible areas can be reduced by designing to permit conductors to slip when a break occurs. The stress relief this provides permits use of lighter supporting structures and foundations.

**Increase use of purchased electrical power by west coast oil refinery** in its current expansion has been dictated by economic circumstances.

## FROM EDITORS IN THE FIELD

**Costs involved in moving circuit breakers were reduced** on the Indianapolis Power & Light Co system by moving them without removing and re-installing ties between breakers. Steel members were welded to the bottoms of the breaker tanks. This holds them together and permits relocation. Welding the tanks together also saves the job of re-alignment at the new location.

# *Mystery:* Why no O-B insulators in the three gunny sacks?

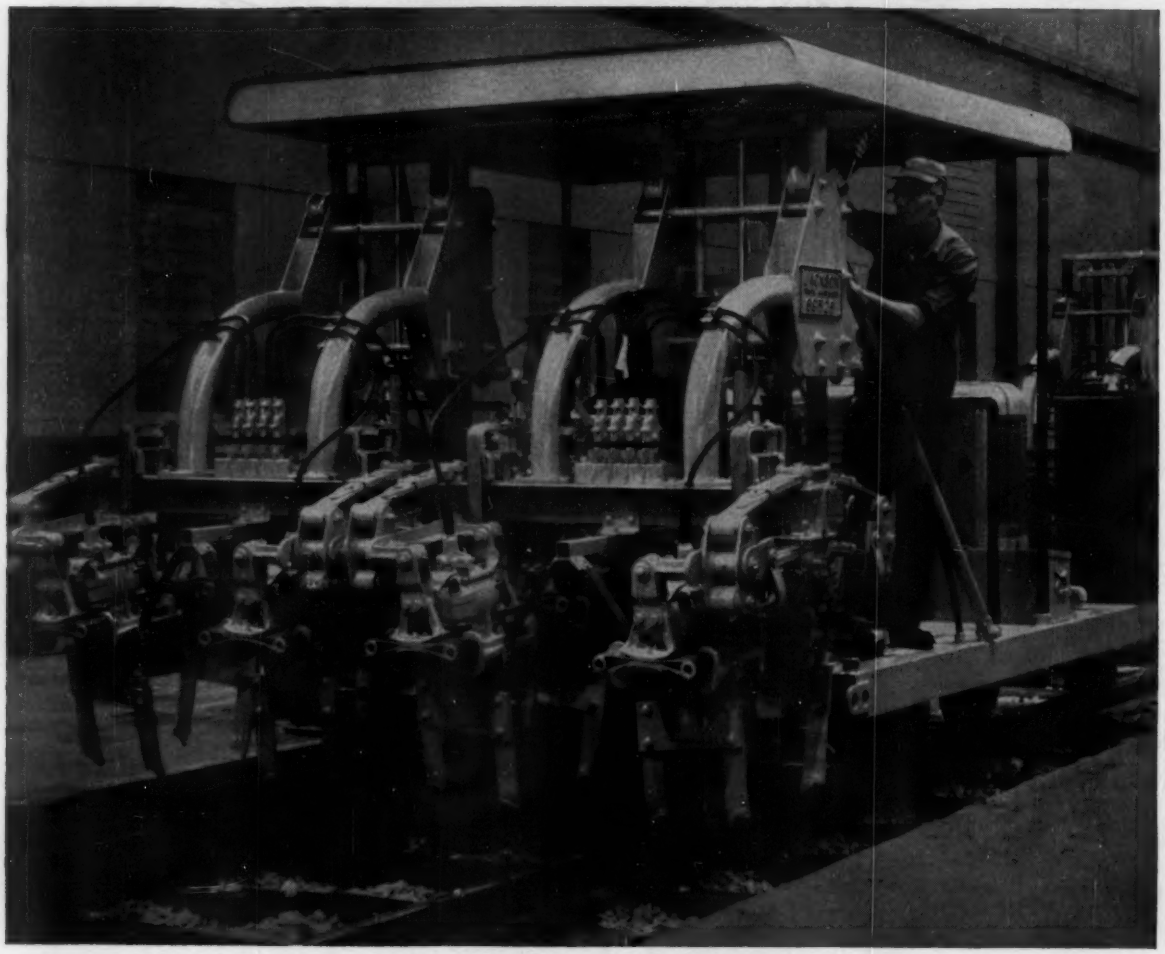
| | |
|---|---|
| *Scene:* | A power company warehouse in South Dakota. |
| *Time:* | Midsummer 1956. |
| *Cast:* | Safety engineer, linemen, Graybar salesman. |
| *Action:* | Group assembled to discuss hot-line practices and treatment for shock resulting from handling defective materials. Among items on display were three gunny sacks full of insulators with pinhole cracks and other defects. |
| *Question:* | How many brands of insulators were represented? |
| *Answer:* | Several. |
| *Question:* | How many O-B insulators were in the three bags? |
| *Answer:* | Not one. |
| *Solution:* | If you want insulators with proved lightning immunity on your distribution lines, always specify Ohio Brass insulators, available from your nearby Graybar warehouse. |

OHIO BRASS COMPANY • MANSFIELD, OHIO

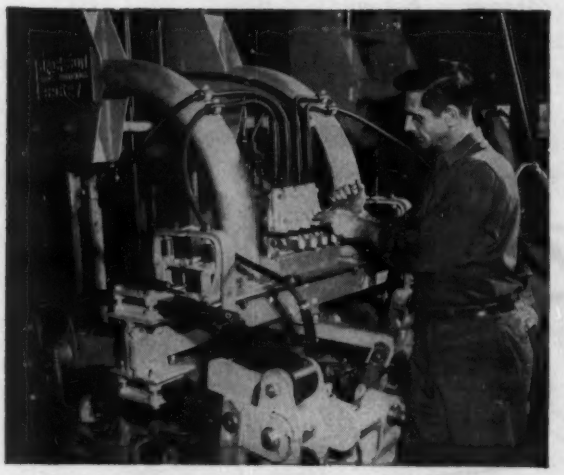
Ohio Brass

4763-H

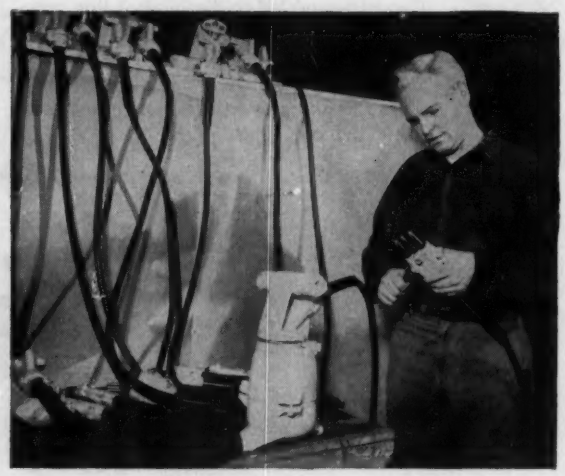
# "Tiger Brand Amerclad is the most



The completely self-contained Jackson Track Maintainer.



Tightening connectors. Machine delivers 4500 2-ton blows per minute.



Assembling leads. Each vibrator delivers ¾ ton blow.

# durable cable we've ever used"

*says* **ELECTRIC TAMPER & EQUIPMENT CO., Ludington, Michigan**

MANY years ago, the executives at Electric Tamper & Equipment Co. found out that when railroads order a piece of machinery, they expect it to last a long time—without breakdowns. Since then, Electric Tamper has won a high place in industry by producing a line of the hardest-working, *toughest* track maintenance machines on the market.

Leader of the line is the Jackson Track Maintainer, used for tamping ties. It has 8 powerful vibratory motors that drive 8 tamping assemblies. Each motor is powered with Tiger Brand Amerclad cable. The vibration and flexing (which are very severe) caused previous cable to crack until the jackets actually peeled away from the conductors. So they asked American Steel & Wire for advice.

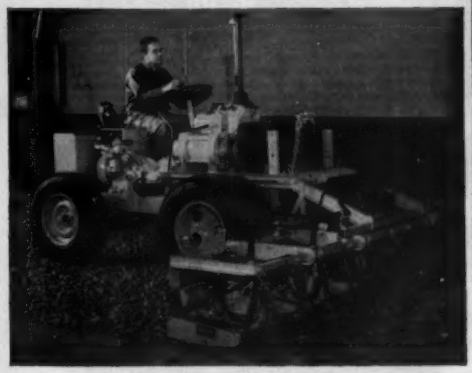
Tiger Brand Amerclad was the solution. Finely stranded conductors soak up vibration and allow greater flexibility than ever before. The tough, well-cured jackets are impervious to oil, grease and the burning sun.

In the company's own words, "Tiger Brand cable is certainly superior to anything we have ever seen for this class of service. Its complete dependability under all service conditions has definitely helped us to maintain our good reputation in the field."

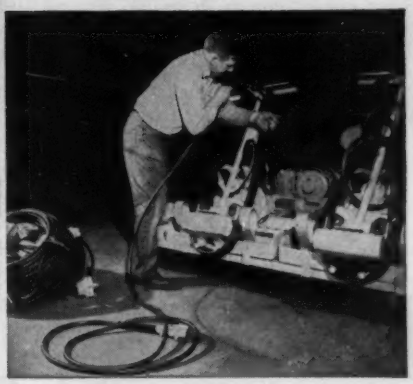
Do you want a *better* electrical cable—engineered for your equipment? Just call your American Steel & Wire representative.

Hand Vibrospade. Cable usually drags on the ground.

The Jackson Multiple Compactor for consolidation of granular soil.



Small compactor. See why they need durable cable?



**AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO**
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

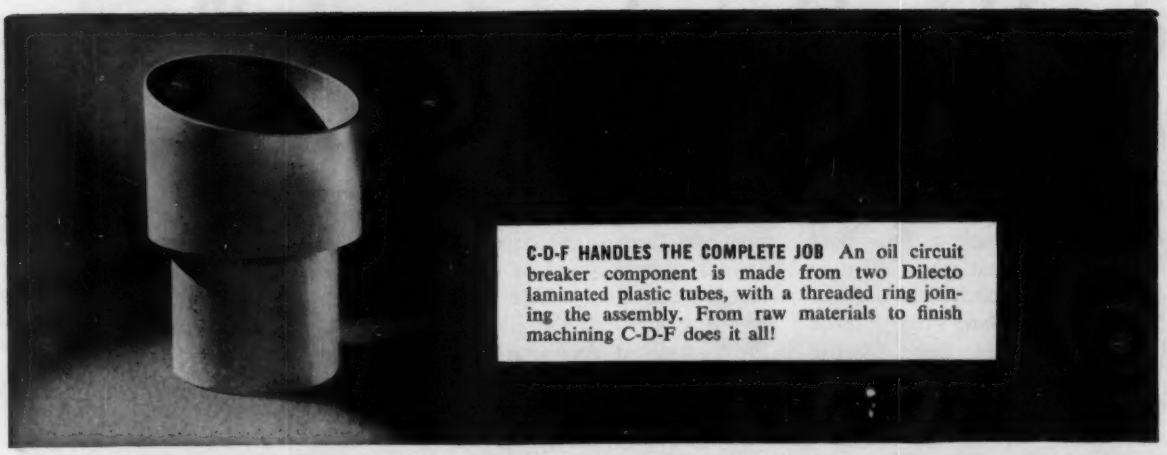
## USS TIGER BRAND ELECTRICAL WIRE & CABLE

*A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB*

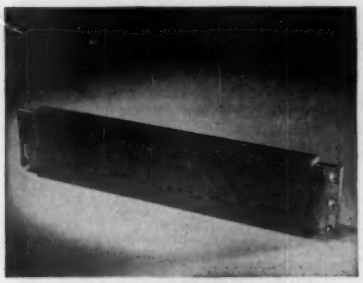
- asbestos wire and cable
- mold cured portable cord
- shovel & dredge cable
- paper & lead cable
- varnished cambric cable
- interlocked armor cable
- special purpose wire & cable
- aerial, underground and submarine cable

USS

UNITED STATES STEEL

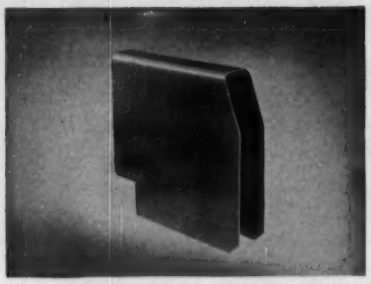


**C-D-F HANDLES THE COMPLETE JOB** An oil circuit breaker component is made from two Dilecto laminated plastic tubes, with a threaded ring joining the assembly. From raw materials to finish machining C-D-F does it all!



**C-D-F KNOWS HOW TO MACHINE PLASTICS.** A bus bar gets a covering of molded Dilecto over copper supplied by the customer. The plastic ends are skillfully trimmed on a smooth saw.

**C-D-F MOLDS MANY SPECIALTIES.** This shaft insulator for a circuit breaker is molded from C-D-F's cloth-based industrial thermosetting plastic, Celoron. Note complexity of mold, clean detailing.

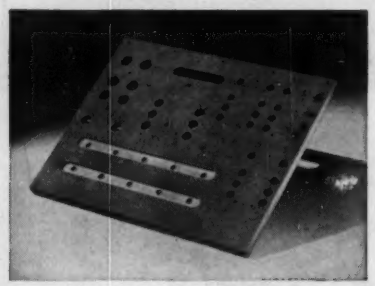


**C-D-F USES MODERN METHODS.** Large quantities of arc chute barriers are made from paper-based Dilecto. Operations include pressing, cutting, post-forming and trimming.

# Dependable equipment relies on C-D-F insulation!

**C-D-F OFFERS UNIQUE MATERIALS.** This contact shaft for an air circuit breaker is another example of molded C-D-F Celoron used in switchgear because of its high impact strength.

**C-D-F IS A SKILLFUL ASSEMBLER.** Made from Grade C rolled Dilecto tubing, these pots are turned, bored, slotted. Then a macerated plastic end is inserted and arc resistant varnish finish applied.



**C-D-F UNDERSTANDS THE ELECTRICAL INDUSTRY'S NEEDS.** Precisely machined to close tolerances, Dilecto panel boards guarantee dependable insulation, help designers save space.

See our catalog in Sweet's Design File for basic product data and sales offices. Write for detailed information, or send us your print for quotation.

CDF

## CONTINENTAL-DIAMOND FIBRE

A SUBSIDIARY OF THE Bird COMPANY • NEWARK 15, DELAWARE

L-M's new open-type Suburbanaire has high utilization of light output for neighborhood streets. Aluminum reflector can be latched directly to a standard NEMA head.

# L-M's New Suburbanaire Provides Efficient, Low-Cost Street Lighting

Here's a big new development in street lighting that offers you a great improvement in performance, operation, and economical long life.

**Large, Efficient Light Source**

L-M's new open-refractor Suburbanaire is more efficient. The open glassware provides for excellent cooling. The refractor is designed to produce a large, efficient light source. Light patterns are developed from the entire refractor, not just from the area next to the reflector. Refractor glassware is available in Type I, standard Type II, Type II 4-way offset, Type III and Type V light patterns. Aluminum reflector is latched for easy attachment to standard NEMA head.

L-M's new Suburbanaire accommodates incandescent lamps up through 6000 lumens and mercury vapor up through the 250 watt (11,000 lumen) lamp.

**Low Maintenance Costs**

Since L-M's new Suburbanaire is open at the bottom, relamping can be done quickly and easily without removing the glassware. L-M's V-band attachment also permits easy field replacement of glassware when necessary.

L-M's new open-refractor design also eliminates the problem of trapped dirt and condensation which may collect in enclosed units.

Ask your L-M Field Engineer or Street Lighting Engineer for more information on features of L-M's Suburbanaire. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

McGRAW EDISON

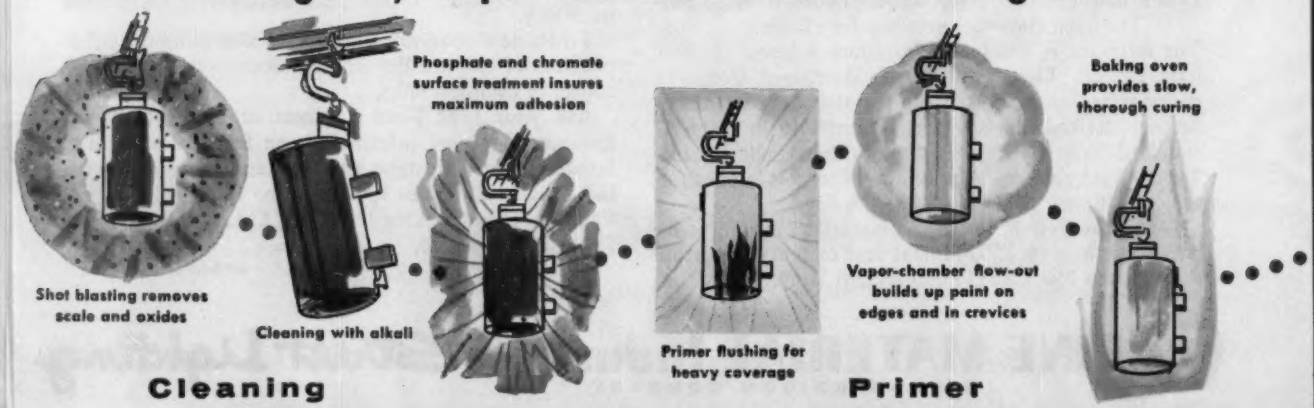
299R

LINE MATERIAL Industries *Street Lighting*

McGRAW-EDISON COMPANY

Tanks are on a continuous conveyor system. Photo shows heavy-viscosity primer as it is flushed on the transformer tank just prior to entering the vapor chamber.

## Flow Diagram, Vapor-Chamber Flow Coating Process


Shot blasting removes scale and oxides
Cleaning with alkali
Phosphate and chromate surface treatment insures maximum adhesion
Primer flushing for heavy coverage
Vapor-chamber flow-out builds up paint on edges and in crevices
Baking oven provides slow, thorough curing
Cleaning
Primer

## Another L-M First...

# New Vapor-Chamber Flow Coating Protects Tank Edges, Crevices

By **MARTIN I. ZWELLING**
Assistant Manager of
Engineering, Transformers
Line Material Industries

Line Material has adopted a revolutionary new vapor-chamber flow coating process that radically improves tank-corrosion protection on L-M Round-Wound® transformers. The outstanding feature is that the vapor-chamber treatment improves paint film thickness and uniformity on edges, in crevices, and over welds—spots that characteristically are the first to rust.

The process includes seven-stage surface cleaning and preparation; flow coating with heavy, viscous primer and finish paints, each coat passing through the unique new vapor-chamber treatment. The secret of the process is that the vapor in the chamber carries a high concentration of paint volatiles. These keep the paint fluid, and the paint actually flows toward and completely covers critical edges, sharp corners, welds, and crevices.

### Automatically Controlled

The heavy paint film is maintained as the tank passes through the baking oven. Humidity and temperature in the oven are closely controlled for proper curing. The entire process is completely mechanized. Automatic controls insure uniform paint coverage.

L-M's newly developed vapor-chamber flow coating process gives better tank protection, partly because it does everything that every previous paint process has done—and does it better—and chiefly because it gives extra protection to areas that are always the first to rust. Here are the principal features:

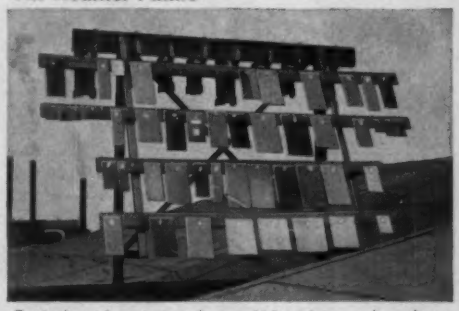
**1.** Thorough seven-stage surface treatment —shot-blasting, alkali washing, phosphating and chromic acid passivation, with intermediate rinses followed by dry-off to insure maximum adhesion.

**2.** Even coverage with highest-grade primer and weather-resistant finish paints.

**3.** Heavy build-up on edges, sharp corners, welds, and in crevices, resulting from flow-out during the vapor-chamber stages.

**4.** No human element—entire process is completely mechanized and automatically controlled.

### All-Weather Paints



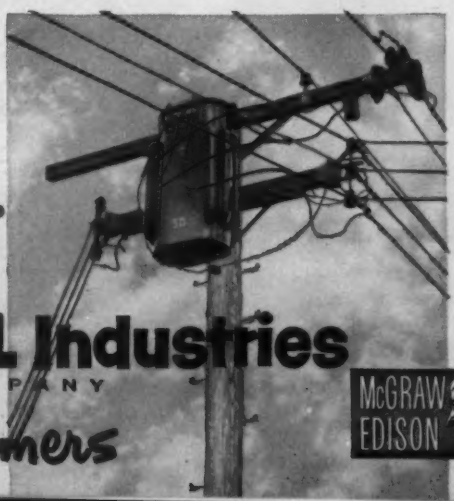
Typical outdoor test rack on which paint panels undergo two-year exposure tests in heavy industrial and seacoast areas. L-M has paints constantly under test—in the laboratory and outdoors.

In the laboratory, paints are subjected to standard tests and special exposures to salt spray and acid fumes which simulate and accelerate atmospheric conditions. From this continuous and extensive testing program L-M selects the paints that best survive these rigorous tests.

### Get Complete Information On L-M Round-Wound Transformers

Tank protection is only one of the important features of L-M Round-Wound transformers. Other advantages are exceptional overload capacity, good regulation, low losses—and *Balanced Performance.* Ask the L-M Field Engineer for complete data, or write Line Material Industries, Transformer Division, Zanesville, Ohio.

Flow-coating with highest grade weather-resistant paint
Finish
Final baking insures long resistance to even the worst atmospheres
Vapor-Chamber Flow-out

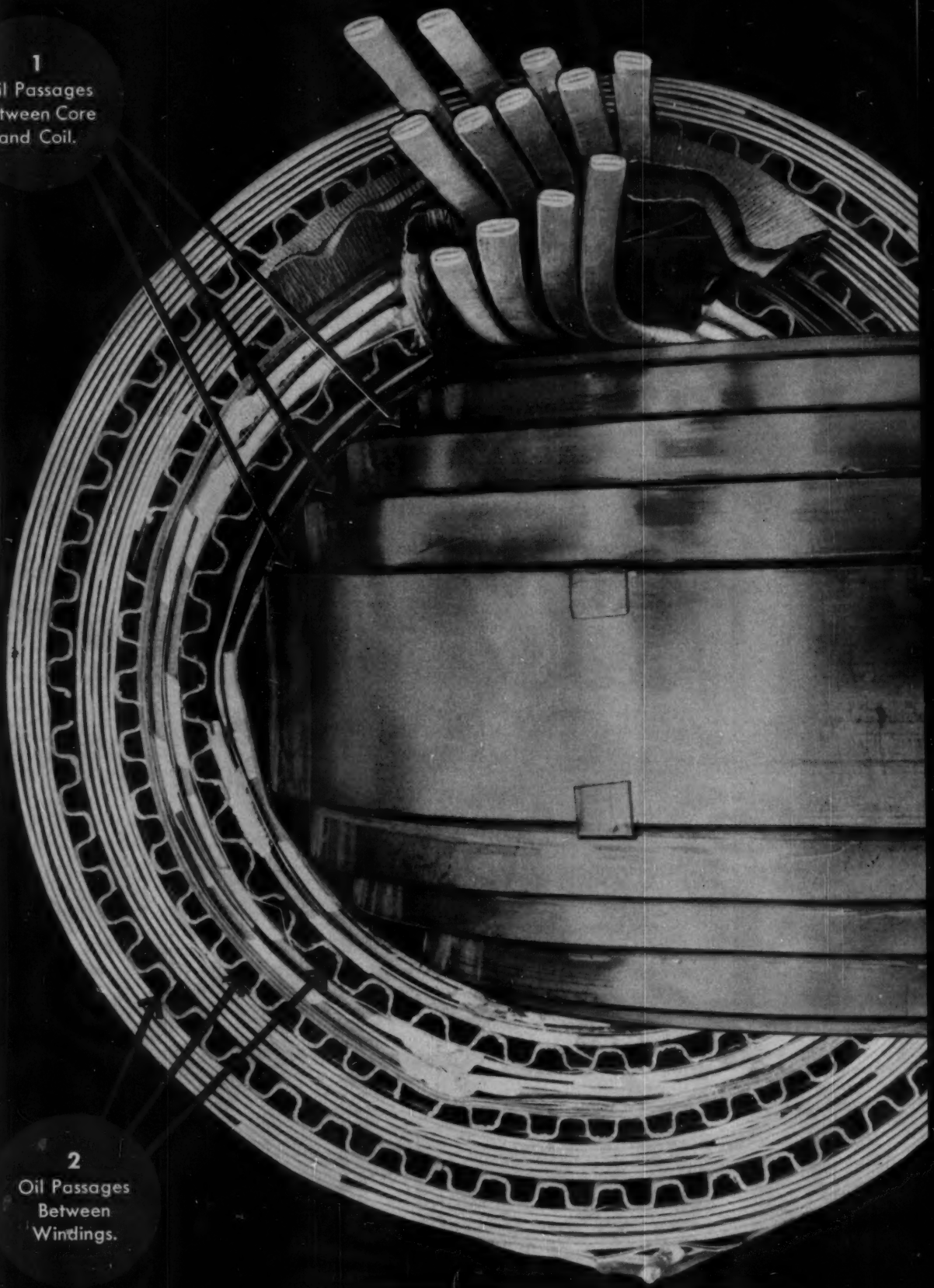


**LINE MATERIAL Industries**
McGRAW-EDISON COMPANY

304-R

Transformers

McGRAW EDISON




**L-M Round-Wound transformers have large, unobstructed areas exposed to cooling oil between core and coil (1), between windings and layers (2), and on the outside of the coil. The result is appreciably lower hot-spot temperature—high short-time overload capacity.**

Here's Why

# L-M's Round-Wound® Core-Coil Design Gives High Performance

By **A. C. WURDACK**
Chief Engineer
Large Distribution Transformers
Line Material Industries

L-M's wound-core, round-coil construction provides the most efficient design for obtaining balanced transformer performance characteristics.

**Low Losses**

The transformer core consists of a tightly wound, continuous strip of high-grade oriented steel. The core is not cut, unwound, or disturbed in any way after annealing. This results, therefore, in low exciting current, low core loss, and high magnetic efficiency.

Core is wound from strips of steel having several different widths, resulting in a cruciform cross-sectional area approaching an ideal round shape.

L-M's Round-Wound core permits the effective use of a round coil which has a much smaller perimeter than a coil placed around a rectangular core of the same cross-sectional area. L-M's design, therefore, permits smaller turn diameters, resulting in lower impedance and better regulation at all power factors.

**High Short-Time Overload Capacity**

L-M's Round-Wound transformers have natural oil passages between the cruciform cross-section core and round coil (1) to provide the greatest possible exposure of coil surface area to cooling oil. In addition, duct spacers placed between windings (2) and between layers in most sizes provide additional oil circulation. L-M's core-coil construction, therefore, provides more efficient dissipation of heat from the coils to the oil. The results are lower hot-spot temperatures, and higher overload capacity, or greater over-all life of the transformer.

L-M's round coils are wound directly onto the uncut core. No malleting is required to shape. Long creepage distance between windings and between leads, gives higher impulse strength.

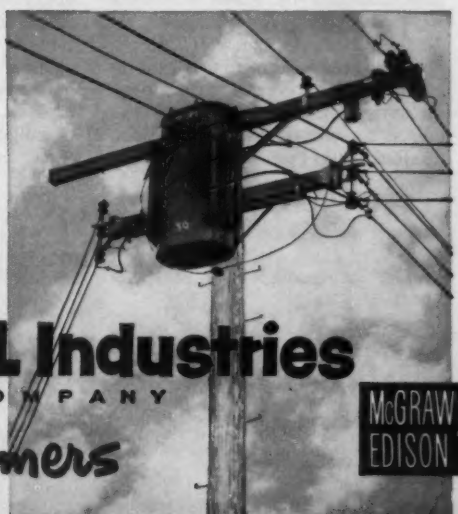
**High Short-Circuit Strength**

Under short circuits, rectangular coils tend to distort to a round shape, with resultant insulation damage or failure. L-M's round coils are not subject to this distortion when under heavy short-circuit currents, because the coils are already circular in shape. The radial forces are distributed evenly, with little or no effect on the coil. Sturdy clamping structure and varnished coils provide strong mechanical support to prevent axial movement.

Another advantage is L-M's new obround tank design. The transformer is smaller, lighter, and has shorter moment arm distance from the pole.

**Get Complete Information**

Ask your L-M Field Engineer for complete information on L-M Round-Wound transformers. Or write Line Material Industries, Transformer Division, Zanesville, Ohio.



LM®

**LINE MATERIAL Industries**

McGRAW-EDISON COMPANY

Transformers

McGRAW EDISON

*Correct Lubrication in Action...*

# LUBRICANT CONSUMPTION CUT 30% PER KW/HOUR!

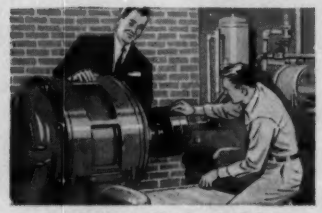
**One of many maintenance savings achieved at Hershey Chocolate Corporation plants with the help of Socony Mobil**

*Moulding famous Hershey bars at world's largest chocolate manufacturing plant.*

Hershey's steam turbo-generators develop over 84 million kilowatt-hours annually to supply its 2066-ton refrigeration units and other power plant needs. Records show that recommendations by Mobil engineers have cut lubricant consumption by 30% per kilowatt-hour. Not a single hour has been lost due to faulty lubrication . . . extremely little wear shown on refrigeration compressor parts—*over a ten-year period.* In addition, production has been improved, maintenance costs cut in many other ways.

Here is another example of Correct Lubrication in Action . . . of the engineering services you get when you rely on Socony Mobil products. You get complete analysis of your plant's lubrication needs . . . recommendations of correct lubricants . . . plant training of your personnel in proper lubrication procedures . . . laboratory analyses of products in use . . . progress reports on benefits achieved. *Can you afford to accept less for your plant?*

**Specify Socony Mobil**
*and get service like this!*

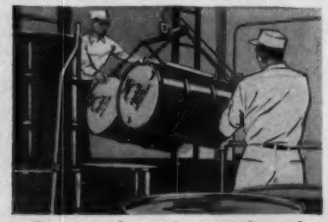


**Leakage eliminated by correct grease**

Oil leakage through flexible couplings formerly necessitated make-up four times a year. Mobil representative recommended greases instead. No make-up required for last two years.

**Over $2000 saved in reclaimed oil**

Following recommendation of Mobil engineer, Hershey plant began reclaiming oil. Now standard procedure, it saves over $2000 annually.



**Storage inventory reduced**

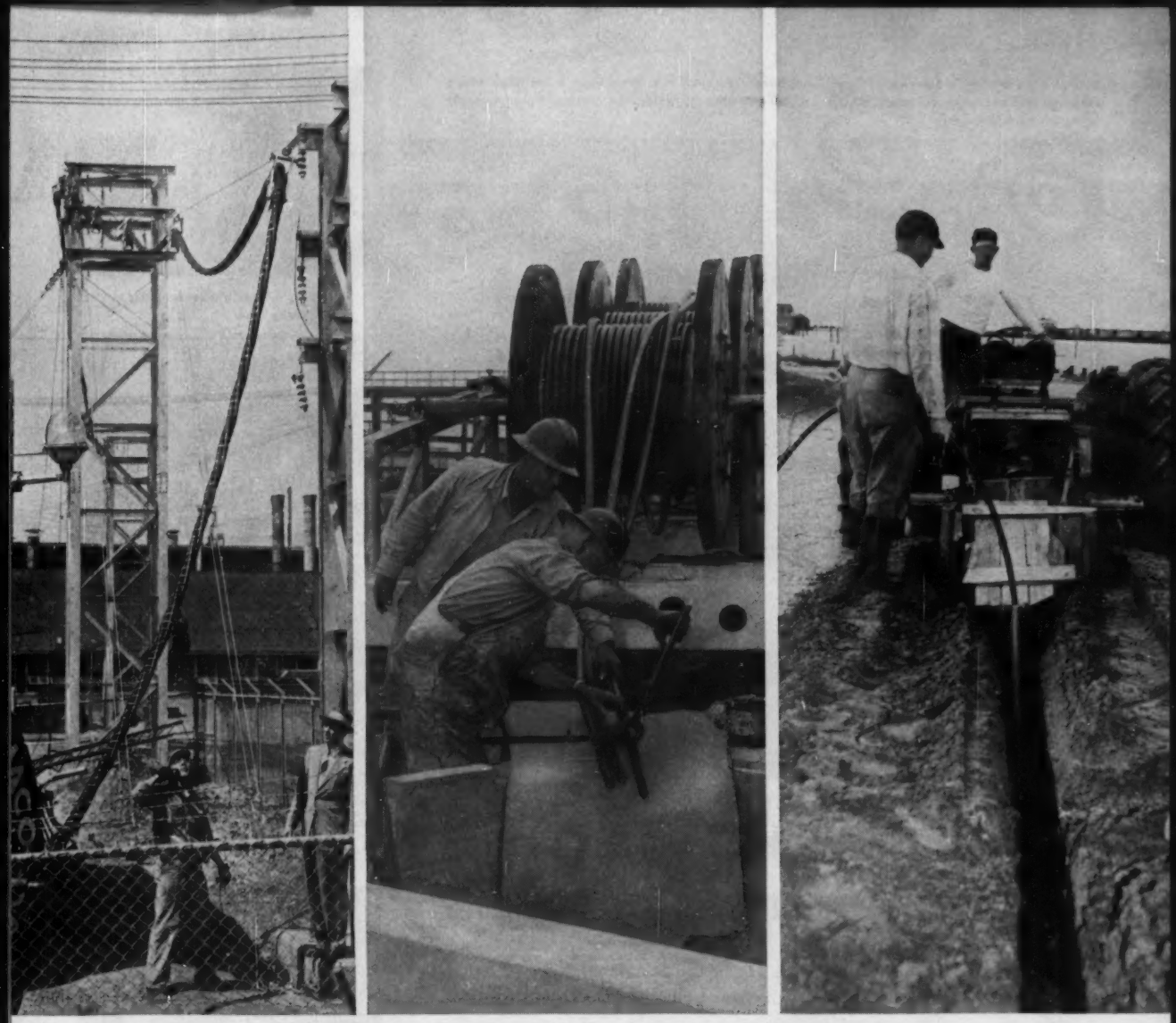
43 grades of lubricants used over a period of years were replaced with 21 Socony Mobil oils and greases. This reduction in inventory cut handling and accounting time.

*Leader in lubrication for 91 years*

**SOCONY MOBIL** Mobil *Correct Lubrication*

**A proved program to cut maintenance costs**

SOCONY MOBIL OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP., MOBIL OVERSEAS OIL CO., INC.



*Overhead . . . in ducts . . . underground*

# Order one cable for all three jobs . . . Anaconda Durasheath

**Overhead . . . in ducts . . . underground.** Use Durasheath* neoprene-jacketed cable for every type of power application up to 15 kv. Tough jacket resists weather, soil acids, abrasion, mechanical injury.

**One continuous run without splices.** Run Durasheath from underground, to overhead, to ducts, *in one length* without splicing. Light, flexible, it handles easily. Costs less to install.

**Stock one cable instead of three.** You save space, paperwork with all-purpose Durasheath. One cable does the work of three. You cut inventory. Versatile Durasheath excels everywhere.

See the Man from Anaconda or your Anaconda distributor for full information. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

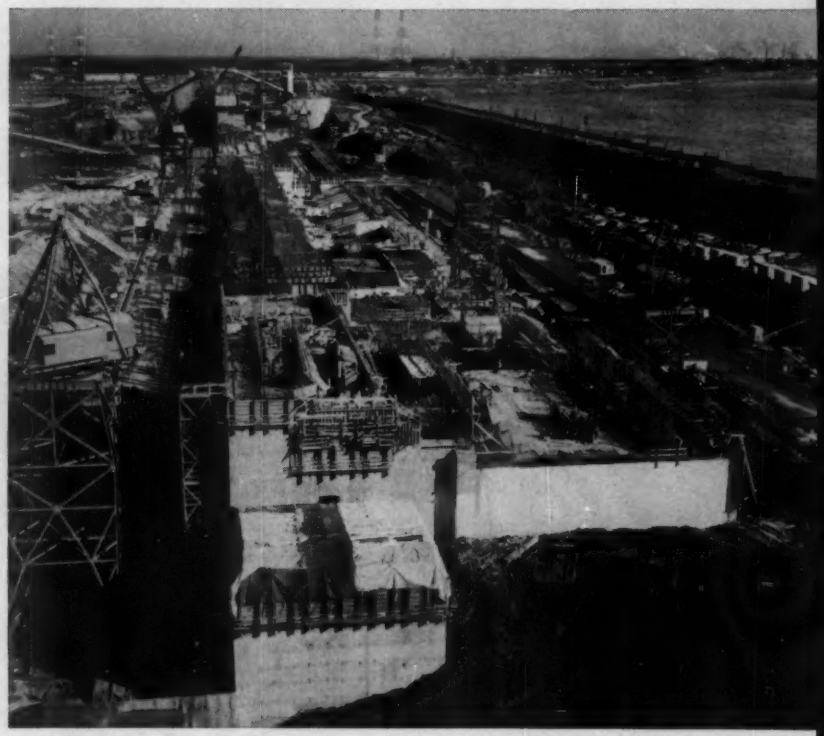
*Trade Mark 57261

LIVE BETTER ELECTRICALLY

ASK THE MAN FROM **ANACONDA®**

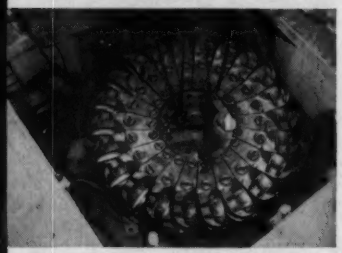
FOR **DURASHEATH CABLE**

Overall view of the St. Lawrence Power Dam, Barnhart Island, N.Y. Here eight B-L-H fixed blade propeller turbines, each delivering 80,000 hp, will be installed. *Photograph courtesy Power Authority of the State of New York.*

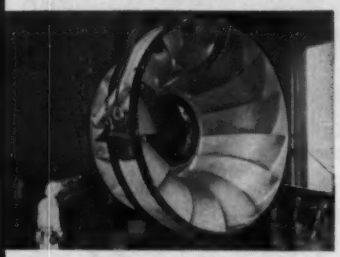


Balancing a fixed blade propeller runner for Wheeler Dam.

Adjustable blade propeller type runner being installed in TVA Fort Loudoun plant.



Impulse turbine runner being installed in the Kemano powerhouse of Aluminium Company of Canada Limited.



Francis turbine runner being unloaded in the Garrison Dam powerhouse.

One of 16 Kaplan turbine governors for The Dalles Dam.

# 4 reasons why B·L·H is your best source for turbines, pump-turbines and governors

1. Excellent hydraulic laboratories for testing scale models. A large accumulation of test data assures correct design of turbines to meet your specific requirements.
2. The Eddystone and Pelton Divisions of B-L-H have been designing and building turbines since 1841. There is no substitute for 116 years of experience.
3. B-L-H builds all four basic types—impulse, Kaplan, Francis and propeller. You can thus be certain that our recommendations are objective.
4. Governors, surge suppressors, valves, special pumps, and other accessory equipment are also manufactured by B-L-H. When we handle your complete turbine project, you eliminate the necessity of coordinating multiple sources of supply.

*For additional information, write B-L-H Corporation, Philadelphia 42, Pa., or Pelton Division (B-L-H), 2929 Nineteenth Street, San Francisco 10, Calif.*

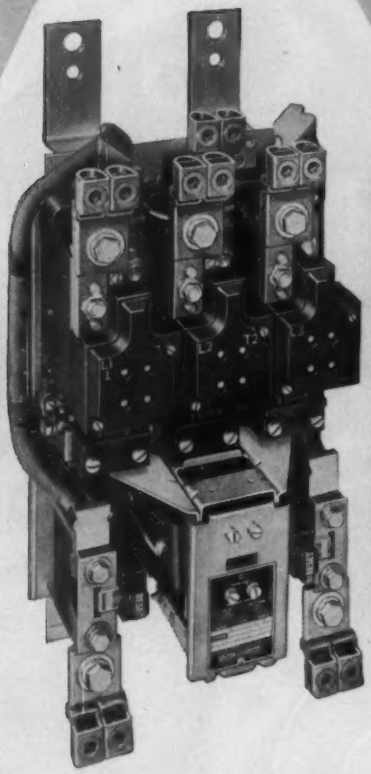
**BALDWIN · LIMA · HAMILTON**

Eddystone Division

Philadelphia 42, Pa.

Hydraulic turbines • Weldments • Dump cars • Nonferrous castings

NEW



SQUARE D

# Vertical Action SIZE 5 STARTER

**Smaller!** REQUIRES ONLY 270 SQUARE INCHES OF SPACE

## DESIGN LEADERSHIP FEATURES IN SQUARE D's COMPLETE LINE OF VERTICAL ACTION STARTERS—SIZE 0 through 5

*What's most important in a motor starter?*

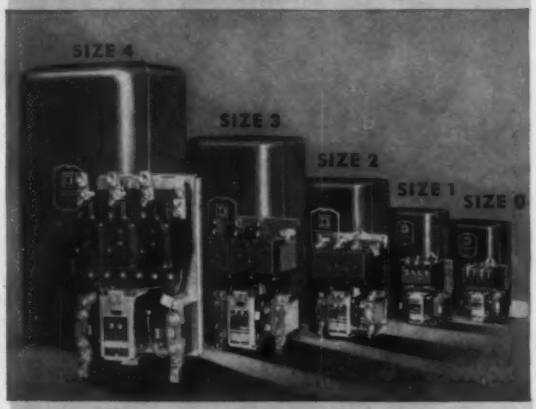
**Performance** and **long life** come first, naturally—and Square D's straight line guided motion and heavy-duty silver alloy contacts assure both. But that's only the beginning—

**Fast wiring** is important, too. Square D gives you a lot of wiring space and time-saving solderless terminals.

**Easy maintenance** rates high. The coils, contacts and overload relays on all Square D starters can be changed in a jiffy...without disturbing external connections. A screwdriver is all you need. And—

**"Off-the-Shelf" Parts Kits** make normal maintenance and "on-the-job" modifications easier than ever. Packaged parts include interlocks, contacts, coils, overload relays, pushbuttons and selector switches. They're easy to buy, easy to identify and faster to install.

*For the complete story, write for Bulletin 8536 Square D Company, 4041 N. Richards St., Milwaukee, 12, Wis.*




EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

# More good jobs per roll

You'll do a better insulating job, save time and tape with Gold Seal Friction Tape. It tears evenly, sticks fast in any weather, conforms readily to uneven surfaces. And one thickness *insulates* — less tape is needed per job. For lasting "tack" and lasting protection, get Gold Seal Friction Tape. Made by Jenkins Bros., Rubber Division, 100 Park Avenue, New York 17.

In 10-roll containers or single rolls.

Each roll sealed in cellophane, stays fresh.

Gold Seal Tape

FOR EVERY APPLICATION

Gold Seal **FRICTION** • **RUBBER** • **PLASTIC Tapes...**

***Commercial and Specification Grades***

# WHO OUGHT TO PAY FOR THE APPLE?

Common logic says, the man who ate it. He receives the benefit, nobody else.

But those who favor "public power" don't concur. They say some people should get the electricity that they consume tax free—and others should ante up the difference with a smile.

The reasoning of the "public power" advocates goes like this: The water that generates power is a gift of nature and should not be allowed to fall into private hands.

Gift of nature it is—like coal, oil, minerals, or any other natural resource. But no resource has any special value until it is extracted, harnessed, or otherwise made useful by human effort. And this effort, which is "privately" exerted by individual men and women, is the real cost of the final product and accounts for by far the greater portion of its price.

Whether produced by "public" or "private" agencies, the power extracted from water, or any source, must still be paid for. And the payment must cover essentially the same costs—labor, tools, materials, and the interest on invested funds.

The "public power" people further say there is a saving when public power agencies do the job, since such agencies pay no taxes. But taxes "saved" by public power agencies are lost to the public treasury and have to be recovered from some other source. What people appear to save as consumers of "public" power, they must give back as taxpayers. Some people do benefit, sure—but at the expense of others. There is no saving to the people as a whole.

So the question of power boils down to this: Under what type of organization—"private" or "public"—is power most likely to be produced most economically, and paid for by those who reap the benefits?

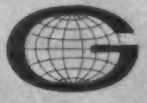
The Western World gave its answer many years ago, after centuries of unhappy experience with "public" control of economic activity.

The answer has paid off richly in terms of efficiency, equity, and freedom.

Are we going to let those gains spill over the dam?*

*Based on material from The Guaranty Survey, published by Guaranty Trust Company of New York.

*Leaflets, reprints and newspaper mats available at cost in page size for publication of this message locally over the signature of your company. Address EW-1, Guaranty Trust Company of New York, 140 Broadway, New York 15, for further information.*



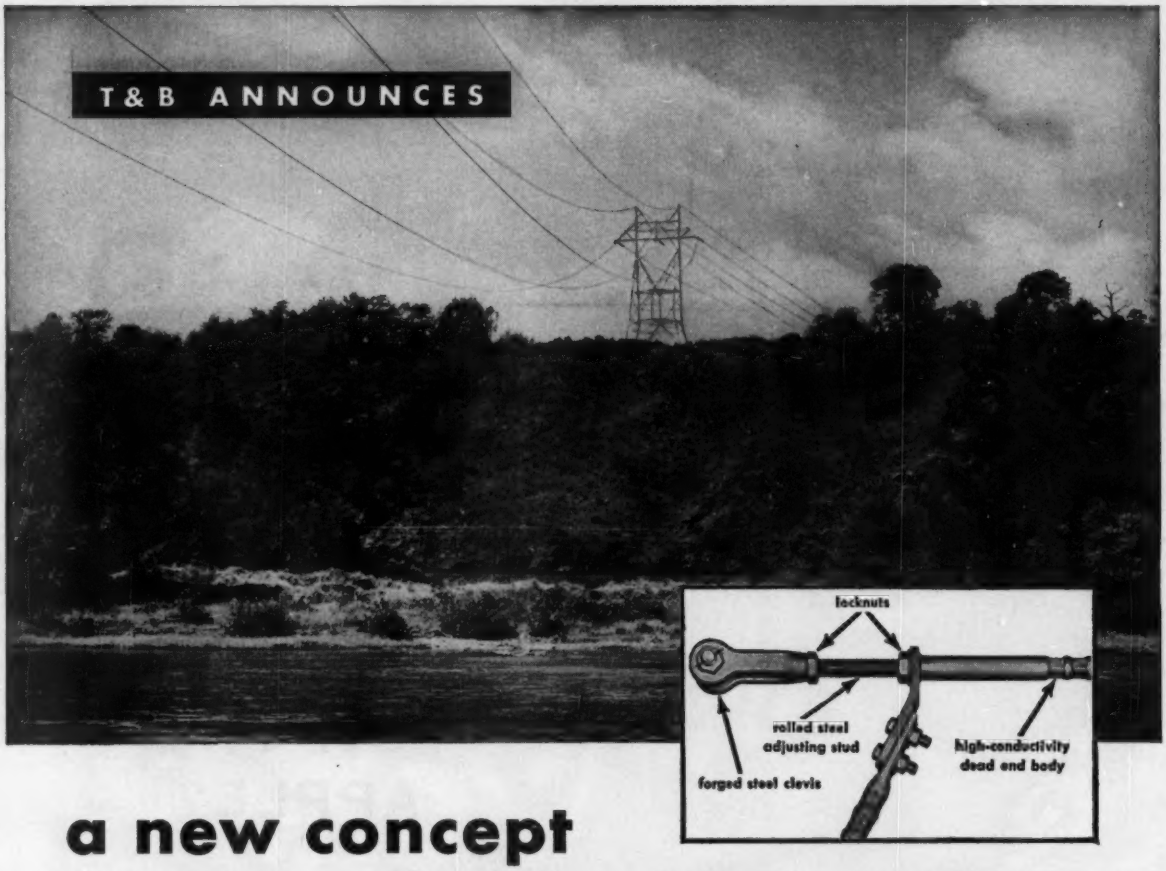

GUARANTY TRUST COMPANY
OF NEW YORK

140 BROADWAY, NEW YORK 15

*Capital Funds in excess of $400,000,000*

Fifth Ave. at 44th St., New York 36 · Madison Ave. at 60th St., New York 21
40 Rockefeller Plaza, New York 20 · London · Paris · Brussels

*Member Federal Deposit Insurance Corporation*




# a new concept in transmission dead ending!

## DEAD END CONNECTORS PERMIT SAG CORRECTION AFTER JOINT IS COMPLETED

Now you can adjust conductor sag to specification after the strain connection has been made! Four inches of clevis adjustment available provides great sag adjustment. For example: in a 700 foot span of 795,000 CM A.C.S.R. sagged at 50% of ultimate strength, the 4 inch clevis adjustment will allow 4 feet of sag adjustment.

The new dead end connector gives many important advantages: transmission line dead ending at river crossing and over rough terrain is simplified, more economical; "bundled" cables can be easily sagged with complete uniformity; line measurement errors can be readily compensated.

T&B Dead Ends are available for all commercial sizes of A.C.S.R. and all-aluminum conductors in three types: single bolting pad, double bolting pad, and with an integral compression loop connection.

*For complete specifications on the new dead ends, as well as the complete new catalog of T&B Method transmission line connectors, tools and accessories, send the coupon below.*

AUTHORIZED DISTRIBUTOR T&B ENGINEERED

LOOK FOR THIS SIGN — IT'S THE MARK OF AN AUTHORIZED DISTRIBUTOR

**THE THOMAS & BETTS CO.** INCORPORATED

14 BUTLER STREET, ELIZABETH 1, NEW JERSEY

Please send me the new T&B Method Bulletin 70

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

# Indianapolis P & L Installs Quiet-operating General Electric Boiler Feed Pump Motors

As part of a $130,000,000, eleven-year expansion program, the Indianapolis Power & Light Company recently installed a new 105,000 kw generating unit at their H.T. Pritchard Generating Station near Centerton, Indiana. The new unit—which includes three new 1250-hp General Electric Boiler Feed Pump Motors—has increased I.P. & L.'s total system capacity about 20%.

Commenting on the quiet operation of the new G-E Boiler Feed Pump Motor design, Mr. D.C. Hess, vice president of I.P. & L., remarked, "I feel that this is a progressive step toward better power plant equipment design. In an area of large rotating machines, these motors with the acoustical treatment will help keep the noise down to a comfortable level. In fact, I have to take a second look to see if the motors are running."

A new standard in quiet motor operation is made possible by a new baffling system in the intake-exhaust chamber, and improved Boiler Feed Pump Motor rotor characteristics. Other features—such as the new bearing system—reduce maintenance, increase reliability and lengthen the life of the G-E Boiler Feed Pump Motor. For more information on these important General Electric features, see the back of this page.

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

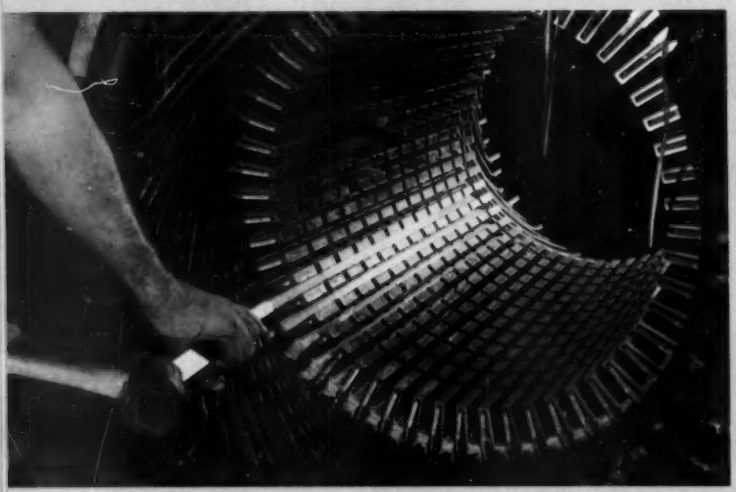
ELECTRIC DRIVES FOR THE ELECTRIC INDUSTRY

***Where electricity is generated, electric drives give top performance***

***. . . here's why***

ELECTRIC DRIVES FOR THE ELECTRIC INDUSTRY

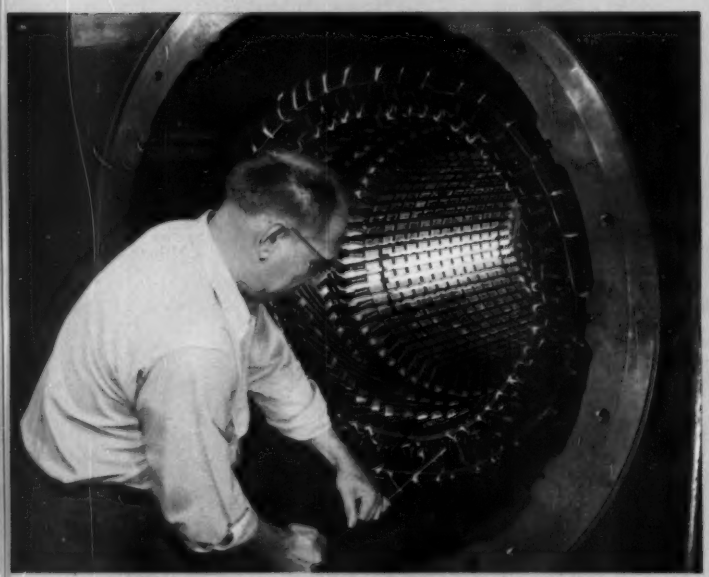
# New Stator Manufacturing Techniques, Materials Extend G-E Boiler Feed Pump Motor Life



**NEW STATOR WEDGING METHODS** are designed to provide tight fitting coils in the General Electric stator. The non-hygroscopic trapezoidal wedges are first checked for accuracy and fit, and then driven into slots and cemented to fillers. This tight, stable fit has virtually eliminated the possibility of wedge and coil looseness.

New manufacturing techniques and materials have been developed and perfected by General Electric to extend the life of G-E stators. These techniques and materials are typical of developments throughout the design of the new Boiler Feed Pump Motor . . . developments that mean greater reliability, easier installation, and reduced maintenance costs on the motors you purchase.

FOR COMPLETE INFORMATION on this important General Electric motor advancement, contact your nearby G-E Apparatus Sales Office or write section 882-5, Medium AC Motor and Generator Department, General Electric Co., Schenectady 5, N.Y.



**IMPROVED COIL WINDING TECHNIQUES** are the result of thorough studies by G-E engineers. Coils are securely tied together and to insulated coil support rings by a patented technique using Permafil-treated glass roving. After baking, the roving becomes rigid and extremely tough, providing maximum winding support.

**DIPPING AND BAKING** of the completely wound stator seals the entire system against moisture and dirt and rigidly bonds the coil bracing. The entire frame is dipped in insulating varnish and baked to help provide more reliable G-E Boiler Feed Pump Motor stators.

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

# This $2-a-year Penta-treated pole plant...

Clean, easy to handle Penta-treated poles *and* crossarms mean economy all along the line... for years to come! Costly material and labor charges for replacements are virtually eliminated. Because of Penta-treated wood's long-term resistance (35 years!) to decay and termite attack, your actual cost per year per pole plant is very small.

Let's take a look at this typical distribution pole plant cost breakdown*:

| | |
|---|---|
| **35′ Class 5 Penta-treated pole** | **$24** |
| **3¼″ x 4¼″ x 8′ Penta-treated crossarm** | **4** |
| **Hardware** | **5** |
| **Labor and equipment to install pole plant** | **37** |
| | **$70** |

***OR, $2 per year per pole plant based on a 35-year life expectancy.***

## ...Can save you $100 in 10 years or less!

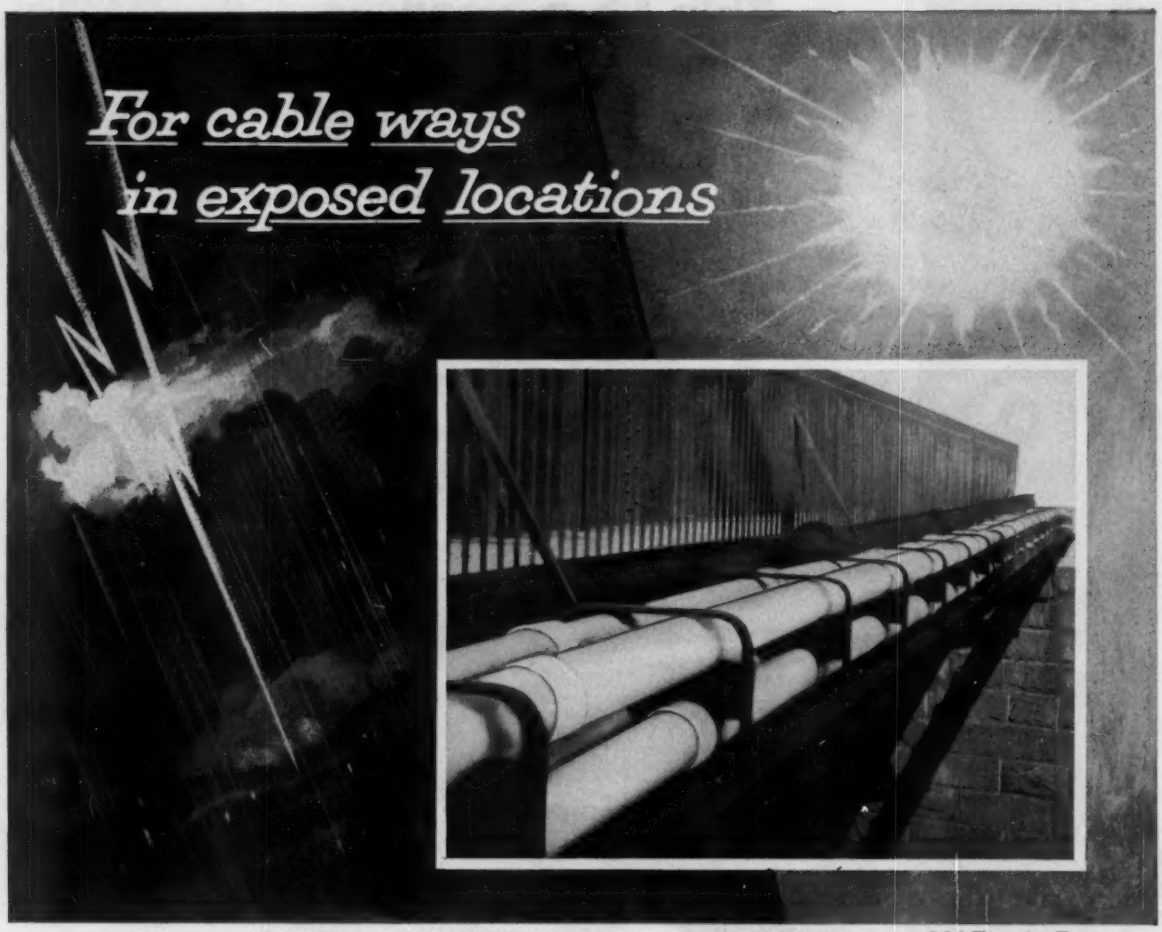
*Crossarms* as well as poles should be Penta-treated. Then crossarm life will match treated pole life. Untreated crossarms usually must be replaced within ten years or less. Installing a Penta-treated crossarm in the first place will save the entire cost involved in removing and reattaching transformers, capacitor racks, etc. These factors considered, replacement costs could well exceed $100—*actually more than the cost of the entire pole plant itself!* For maximum economy, specify Penta for your *whole* pole plant.

Organic Chemicals Division
MONSANTO CHEMICAL COMPANY
Dept. PI-14, 800 N. 12th Blvd.
St. Louis 1, Missouri

MONSANTO®

**WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU**

**Average estimated costs.*




**OUTDOORS** in extremes of weather and temperature—J-M Transite Ducts stay corrosion- and rot-free without paint or surface treatment of any kind.

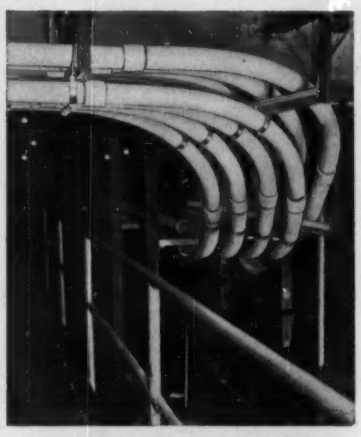
# J-M Transite® Ducts give long, trouble-free service ... never rust, rot, or corrode

Wherever you *see* conduit—in exposed locations indoors or out—you see more and more of the conduit that *really* protects—Johns-Manville Asbestos-Cement Transite Ducts.

**To cut circuit losses,** Transite provides complete circuit isolation with a non-conductive, non-inductive barrier of asbestos and cement. Because it is made of incombustible, completely inert materials, Transite protects adjacent cable runs from the flame and heat of burnouts even at extreme temperatures.

**To eliminate raceway maintenance,** Johns-Manville Transite Ducts offer you a raceway that is built to take exposure to weather and corrosive atmospheres. No need to paint and repaint—because Transite resists corrosion, fungus, and rot—resists the heat and flame of extreme-temperature burnouts.

Let us send you free brochure EL-29A. Write Johns-Manville, Box 14, New York 16, New York. In Canada: Port Credit, Ontario.

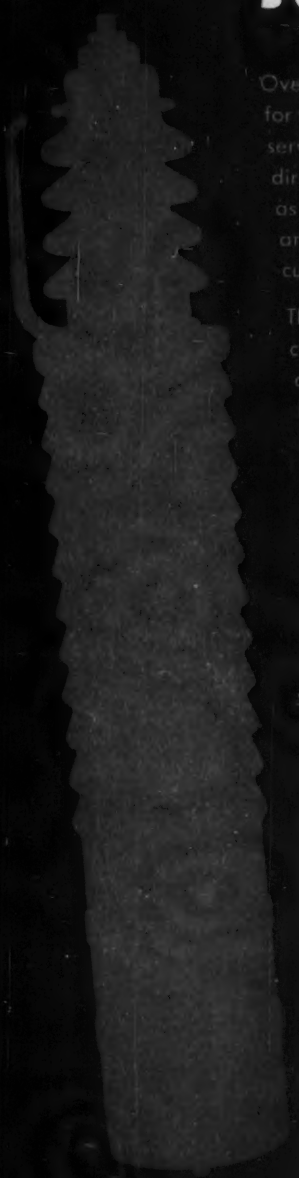


**INDOORS**— Transite's light weight, quickly assembled tapered couplings, and pre-shaped bends offer installation speed to match Transite's low maintenance requirements.

## Johns-Manville TRANSITE DUCTS

Made of Asbestos-Cement

**J-M Conduit for exposed and underground installations without concrete**
**J-M Korduct® for installation in concrete**



# JOSLYN announces the addition of a VALVE ARRESTER to its line of protective equipment.

Over 20 years ago Joslyn introduced a new expulsion arrester to meet the urgent need for trouble-free, effective performance under severe lightning conditions. The unequalled service record of more than 2,000,000 of these arresters continues to demonstrate direct-stroke protection and the validity of the claim . . . POSITIVE PROTECTION . . . as applied to Joslyn Expulsion Arresters. The unimpeded discharge path of these arresters, which makes possible this outstanding performance, brings with it fault-current limitations.

The extraordinary growth in the use of electricity in recent years has required the capacity of power systems to be increased beyond all predictions, particularly in dense urban areas. In such areas, the fault-current ratings of expulsion arresters may be exceeded . . . also, their severe lightning capabilities are not needed because of extensive shielding. On the other hand, valve arresters are suitable for such applications because their built-in resistance element makes them insensitive to fault-current magnitude . . . also, their reduced protective ability is not detrimental because of limited lightning duty in dense urban areas.

Seeking one arrester to meet the diverse requirements of severe lightning and excessive fault current, Joslyn initiated a research program five years ago to determine if recent advances in the physics of solids, particularly semi-conductors, permitted the design of an "all-purpose" arrester; and if not, to develop a superior valve arrester. This research has not disclosed a new valve material to attain the "all-purpose" arrester . . . but advanced knowledge gained has enabled the design of a substantially improved silicon carbide valve arrester.

*The Joslyn Valve Arrester incorporates improvements in the two basic components of a valve arrester:*

### *I. Arc Quenching System*

**a. Circular gap structure produces magnetic blow-out—gives necessary arc elongation proportional to current magnitude without auxiliary coils and surge by-pass means**

**b. Horizontal gaps prevent short circuiting by beading—preserve initial gap spacing**

**c. Inner-structure vent holes prevent arc-generated metallic deposits from shorting critical gap insulation**

**d. Capacitance plates establish uniform voltage distribution across gaps**

### *II. Valve Element*

**a. Selected grain sizes give high density element with exceptional heat capacity**

**b. Silicon carbide, without cement or binder, improves stability against decomposition and channeling**

*The Joslyn Valve Arrester is a superior valve arrester.*

. . . Laboratory tests, far more severe than industry standards, have proven its qualifications.

. . . Two years of field service have demonstrated its ruggedness and reliability.

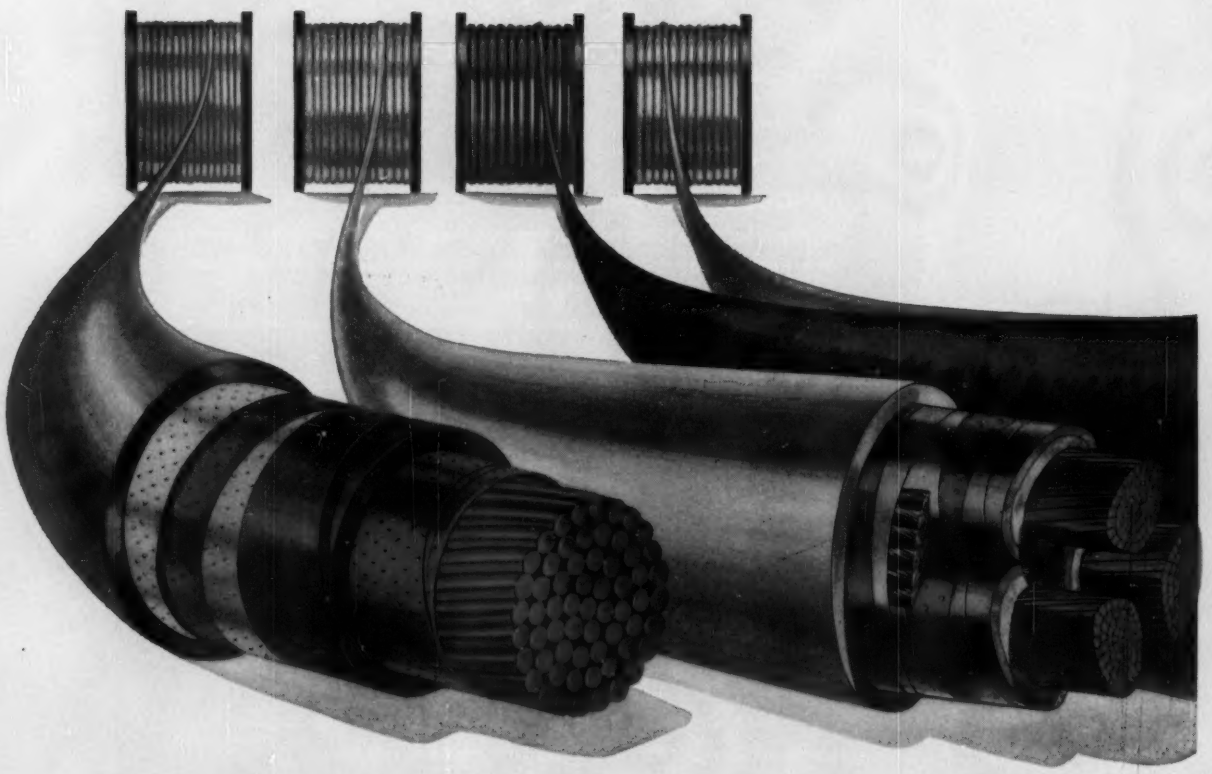
**JOSLYN MFG. AND SUPPLY CO.**

155 N. WACKER DRIVE • CHICAGO 6, ILLINOIS

JOSLYN COMPLETE POLE LINE EQUIPMENT

FOR THE MOST EFFICIENT
POWER DISTRIBUTION... SPECIFY

# PAPER-INSULATED CABLES BY PHELPS



Single conductor, 1 KV and up

Three-conductor, 1 KV and up

**DODGE!**

Phelps Dodge paper-insulated power cables have a *demonstrated record* of long life in a great variety of designs for all types of applications—underground duct, direct burial, submarine and aerial.

Paper-insulated cables have these important inherent characteristics that improve operating performance and lengthen service life:

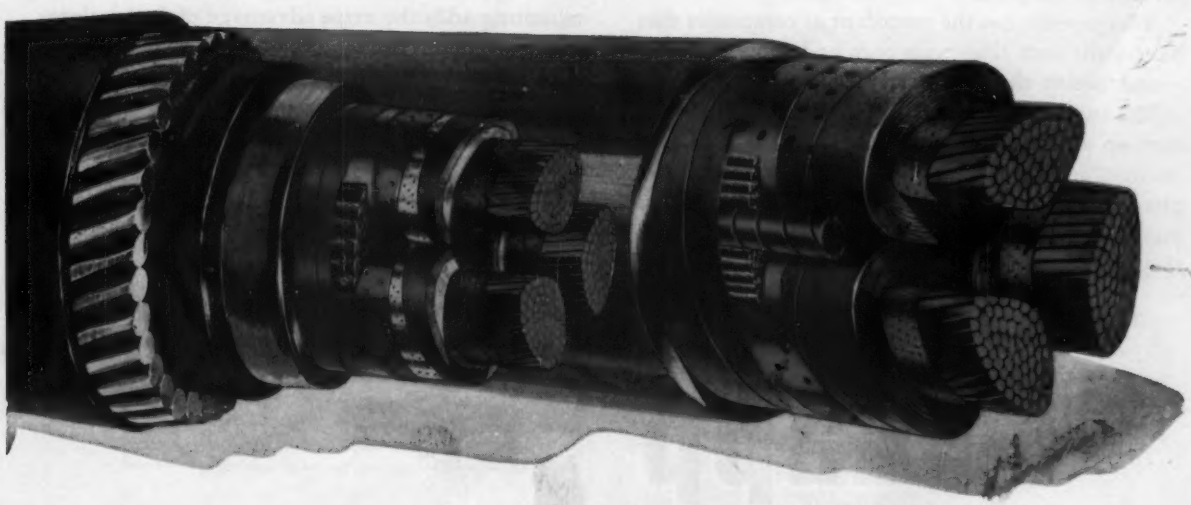
- Extra high 60-cycle and impulse strength to withstand switching and lightning surges.
- Ability to handle large blocks of power in single cables of minimum dimensions.
- Positive protection against all contaminations, due to being hermetically sealed in an extruded metallic sheath.

Paper-insulated cables can be supplied with either lead or aluminum sheaths.

***Phelps Dodge offers the widest range of high voltage cables to the electrical industry.***

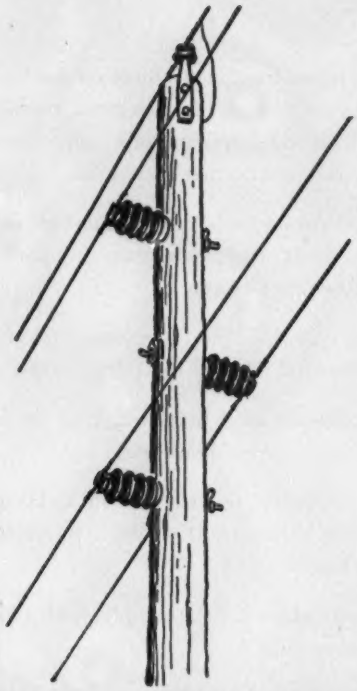
# PHELPS DODGE COPPER PRODUCTS CORPORATION

300 PARK AVENUE, NEW YORK 22, NEW YORK



Submarine, 1 KV and up

Low-Pressure gas-filled, 8 KV and up



# A TROUBLE-FREE DISTRIBUTION LINE AT LOWEST COST

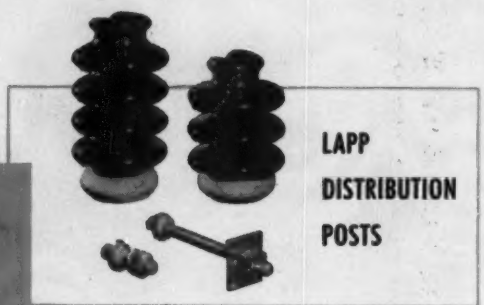
You can eliminate the cost of cross-arms, aces, brackets and other hardware—and probably uild the best-performing distribution line on your stem—by using new Lapp Distribution Post insulators. You just mount 'em horizontally, bolted directly to the pole.

This practice has the precedent of companies that have built such lines with regular Lapp Line Posts —and report them as "completely trouble-free."

The two Distribution Post units, for duty at voltages up to 25 Kv, both develop 1500 lbs. cantilever strength at insulator top. Constructed as a solid one-piece porcelain, they are completely crack-proof and puncture-proof. With Lapp Fog-Type corrugations, they present an exposed uniform leakage path—most efficient for use in contaminated atmosphere. Radio-free by design, and greatly more rugged than any other type of distribution insulator against flashover, stones and bullets. Separable stud bolts provide for their use with studs of any length.

For application in dirt condition areas, horizontal mounting adds the extra advantage of *better* cleaning in wind and rain.

Write for complete description and specifications. Lapp Insulator Co., Inc., Le Roy, N. Y.




**Lapp**

Shown at Bell Laboratories, Murray Hill, N. J., are, left to right, F. J. Herr, S. T. Brewer, L. R. Snoke, E. E. Zajac and F. W. Kinsman.

# They're wiring the seas for sound

These five Bell Labs scientists and engineers may never "go down to the sea in ships." Yet, they're part of one of the most exciting sea adventures of modern times. Along with many other specialists, they are developing the deep-sea telephone cable systems of the future.

Here's how they join many phases of communications science and engineering—to bring people who are oceans apart within speaking distance.

**F. J. Herr, M.S.,** Stevens Institute, is concerned with systems design and analysis. He studies the feasibility of new approaches and carries out analysis programs to select optimum parameters for a proposed system design.

**S. T. Brewer, M.S. in E.E.,** Purdue, communications and electronics engineer, explores new designs for sea-bottom amplifiers needed to step up power of hundreds of simultaneous telephone conversations.

**L. R. Snoke, B.S. in Forestry,** Penn State, is the team biologist. He investigates the resistance of materials to chemical and microbiological attack in sea water. Materials are evaluated both in the laboratory and in the ocean.

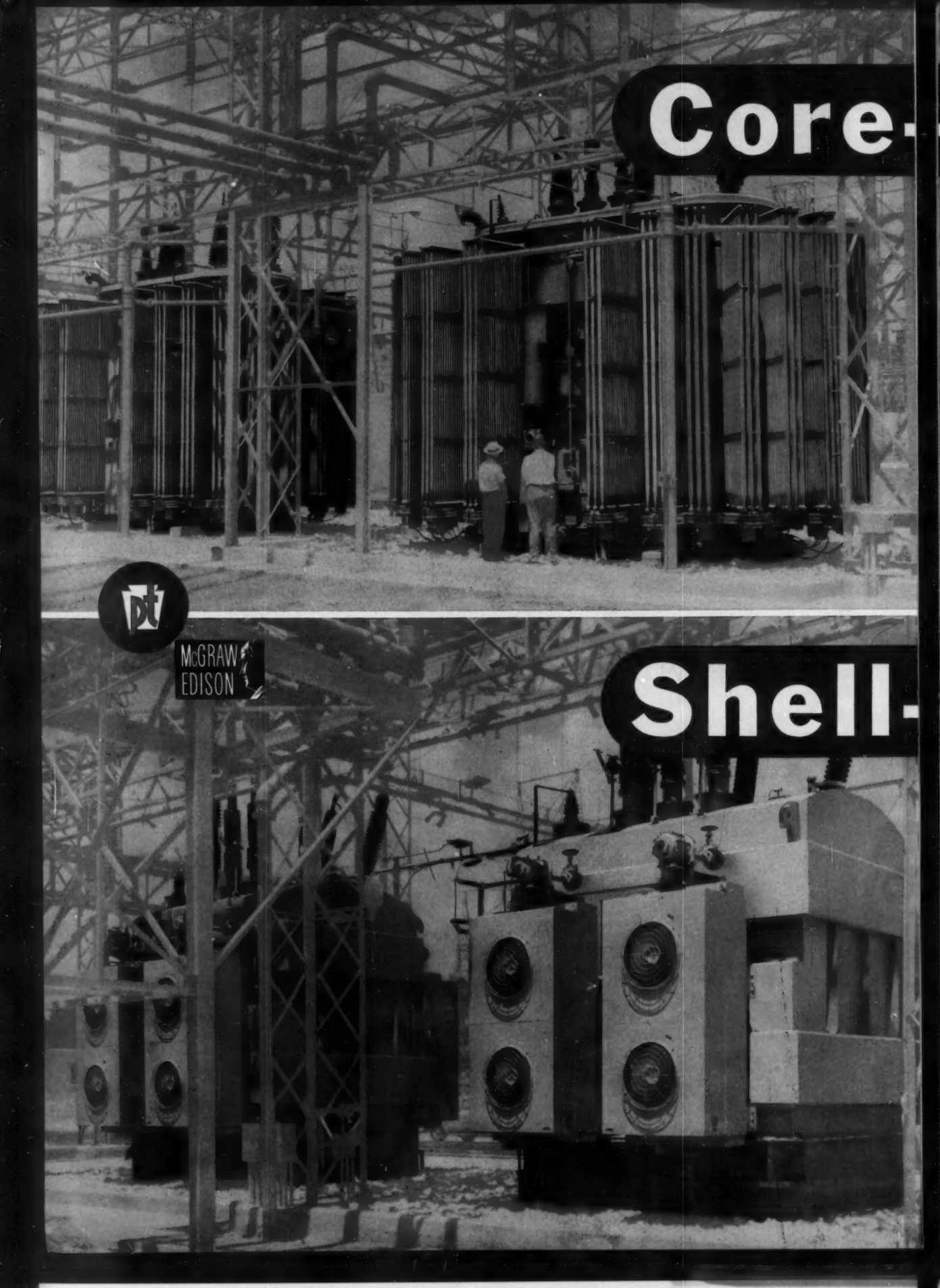
**E. E. Zajac, Ph.D. in Engineering Mechanics,** Stanford, is a mathematician. He studies the kinematics of cable laying and recovery. Cable's dynamic characteristics, ship's motion, the mountains and valleys in the ocean bottom—all must be taken into account.

**F. W. Kinsman, Ph.D. in Engineering,** Cornell, solves the shipboard problems of storage, handling and "overboarding" of cable. New machinery for laying cable is being developed.

Deep-sea cables once were limited to transmitting telegraph signals. Bell Labs research gave the long underseas cable a voice. New research and development at the Labs will make this voice even more useful.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT


Core-
McGRAW EDISON
Shell-

# -form?

## Pennsylvania builds both types of power transformers . . . choosing the best design for each application

Pennsylvania Transformer builds *both* core-form and shell-form power transformers because there are inherent advantages to be found in both designs. Whether core-form or shell-form design is best for a given kva and voltage in a particular application depends on such factors as size and weight . . . ease of installation . . . impedance . . . application of insulation . . . method of cooling, etc. In cases where there is no particular advantage to be found in either design, the purchaser's individual preference may prevail.

By taking advantage of Pennsylvania Transformer's wide experience in both core-form and shell-form design, you can be certain that every power transformer installed is the "right" transformer for that particular application. Contact Pennsylvania Transformer Division, McGraw-Edison Company, Box 330, Canonsburg, Pa.

# -form?

## 350,000 kva Pennsylvania transformer installation includes both core-form and shell-form Generating Station Units

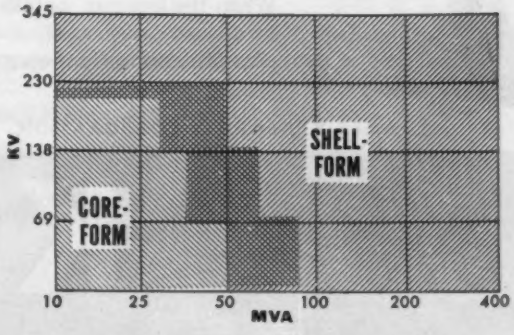
The pictured installation of main generating station transformers effectively illustrates Pennsylvania Transformer's versatility in the field of power transformer design. Both the core-form units, above, and the shell-form units are located at the same generating station, where they perform step-up service for two different generators.

The two core-form units are each rated at 56,000 kva when self-cooled, and at 70,000 kva when the forced-air cooling is in operation. Connected to a 110,000-kw generator, they step up a generated voltage of 15 kv to 132 kv.

The two shell form units are each rated at 105,000 kva, using forced-oil-to-air heat exchangers. Connected to a 156,000-kw generator, they step up a generated voltage of 19 kv to 132 kv.

Core-form or shell-form? Why not let the answer for your next transformer be based on Pennsylvania's proved principles of power transformer design?

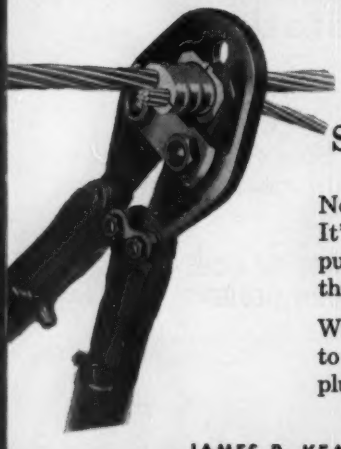
**TYPICAL APPLICATIONS OF CORE-FORM AND SHELL-FORM DESIGNS**




**PENNSYLVANIA POWER TRANSFORMERS**

# Now...**KEARNEY** puts the inhibitor in for you!

Each operation of this machine forcefully applies the right quantity of Kearnalex within the jaws of the Squeezon.



## it's automatically applied inside the Squeezons . . . at the KEARNEY Plants

Now there's no need to take up time on the job applying inhibitor to each connection. It's already there—in the proper place—in the proper quantity—because KEARNEY puts it inside the jaws of these Squeezons at the plant under ideal conditions . . . then packages each Squeezon in a heat-sealed plastic bag.

When the lineman installs the Squeezon on conductors, application of the Kearnalex to all necessary surfaces is *automatic* and *complete*. Convenient . . . time-saving . . . plus protection from corrosion and oxidation. Order your stock today!

**JAMES R. KEARNEY CORPORATION,** *General Offices:* 4224-42 Clayton Ave., St. Louis 10, Mo.

FOR BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify

# KEARNEY SQUEEZONS

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. GUELPH, ONT.

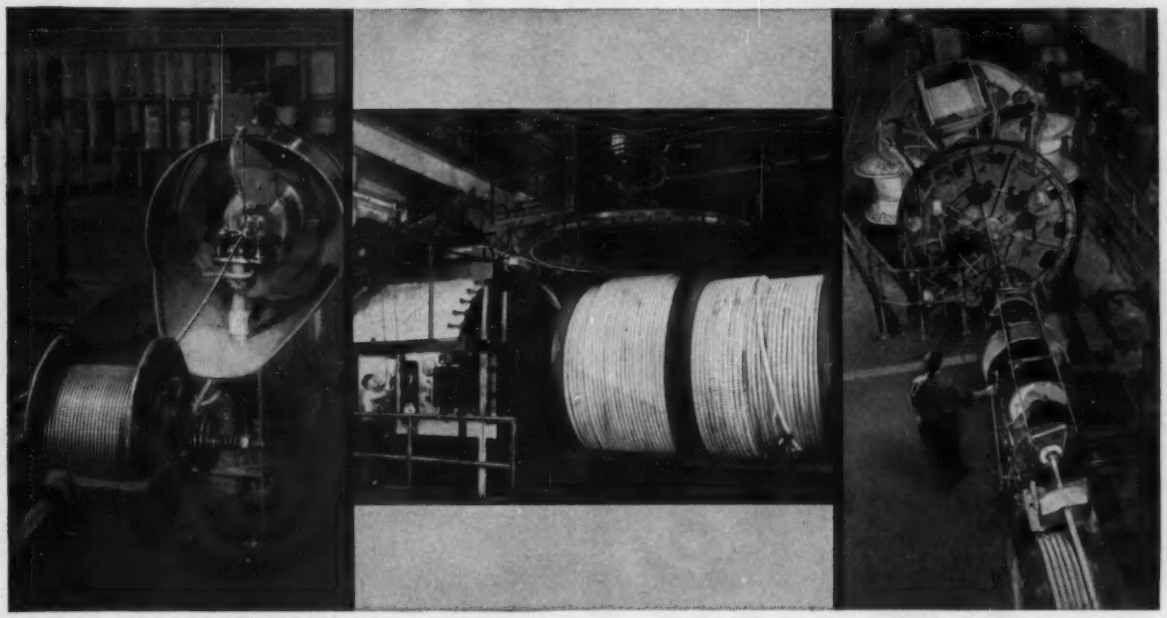
The Mark of Quality

Plants at: ST. LOUIS — FAYETTEVILLE, ARKANSAS — SHENANDOAH & COLFAX, IOWA — GUELPH, ONTARIO, CANADA

**GENERAL CABLE**

# PAPER INSULATED
## VERSATILE · RELIABLE
# POWER CABLES

**Manufactured at BAYONNE, N. J. • ST. LOUIS, MO. • EMERYVILLE, CALIF.**



This machine forms steel strip into helical coil ducts or channels for use in gas filled or oil filled cable.

Impregnating Tank utilized in the heat-vacuum drying and oil impregnation steps in the manufacture of Paper Power Cable.

Large Cabling Machine used in cabling individually insulated conductors into multiple conductor assemblies.

- **SOLID TYPE**
- **LOW PRESSURE GAS FILLED**
- **LOW PRESSURE OIL FILLED**
- **PIPE TYPE**
  - **High Pressure Gas Filled**
  - **High Pressure Oil Filled**

The excellent operating record over many years and the superior electrical characteristics of paper insulated cable highly recommends its use for all power applications. Paper Power Cable is a predominant type in preference and use for voltages above 5 KV.

General Cable Corporation is equipped with the finest modern facilities for paper taping and with many years of know-how is in a position to supply a high quality product for all low and high voltage applications.

**GENERAL CABLE CORPORATION**
420 Lexington Avenue, New York 17, N. Y.
*Offices and Distributing Centers Coast-to-Coast*

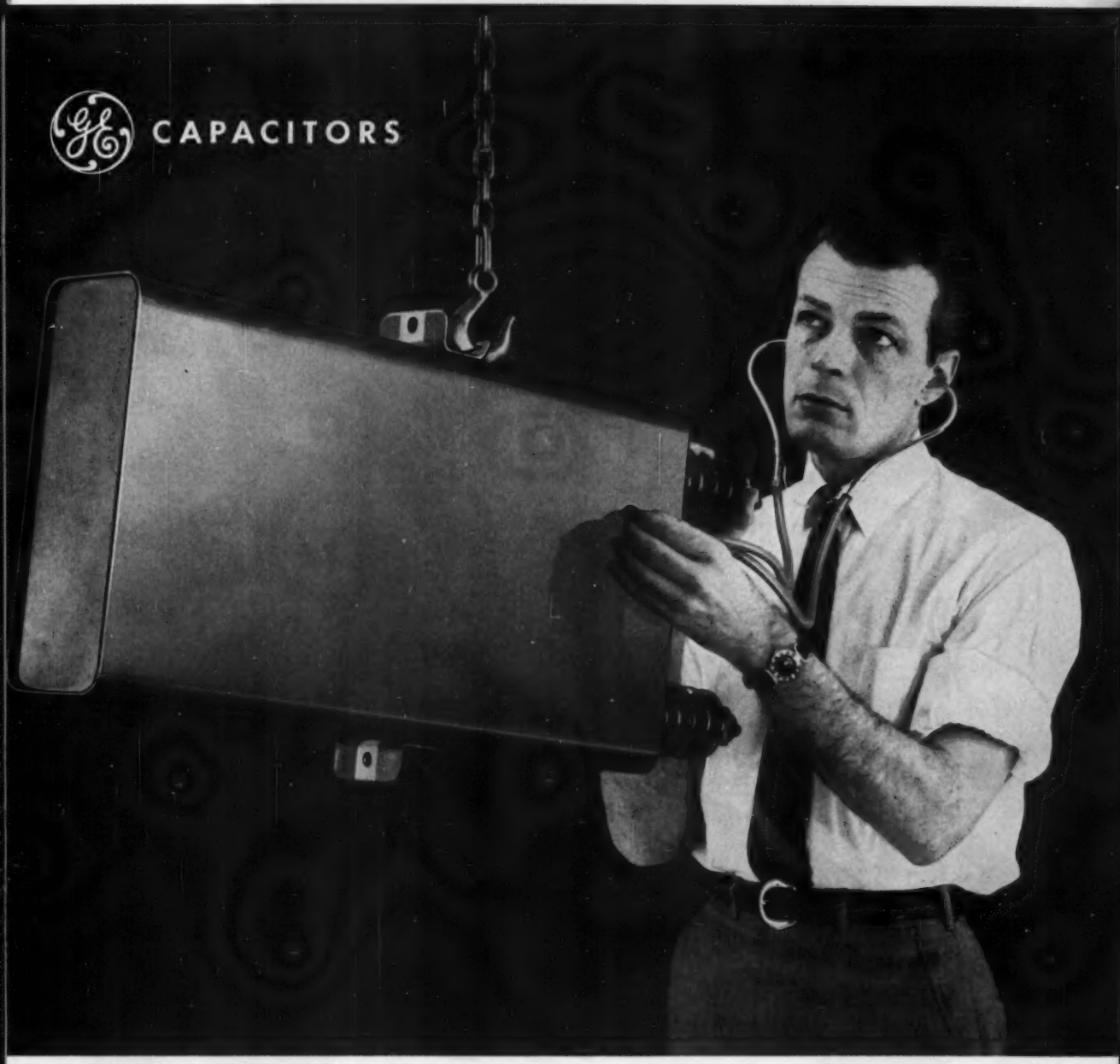
***for quality and economy...*** **specify GENERAL CABLE**

• Bituminous coal contributes to plant operating profits by its *productivity* and *stability*. Virtually limitless supply, plus most modern mining methods, gears production to *any volume demand*.

Accessibility and increasingly efficient burning equipment mean economical, constant-cost for today and tomorrow.

B&O

*Ask our man!* BALTIMORE & OHIO RAILROAD, BALTIMORE 1, MD., Phone: LExington 9-0400




# Silent...and completely filled

General Electric capacitors don't gurgle because they are filled to the very tops of the bushings. Tip one and listen; test one with a stethoscope; or just tap it with a coin. You can double-check by looking into the glass bushings.

Why such tests? Because air bubbles in a capacitor can do more than gurgle. They can cause internal flash-over and failure. Even if the unit is mounted upright, you can't be sure a bubble hasn't been trapped in the winding to cause subsequent trouble.

No air gets in G-E capacitors because, after each unit is completely filled with Pyranol* under a vacuum pressure, the fill-hole is sealed under Pyranol. Result: no voids, no air channels, no weak spots where failure can start.

This is another of the Engineered Extras you get with G-E capacitors. Ask your General Electric Apparatus Sales Engineer to tell you more. Or write to General Electric, Section 445-5, Schenectady 5, New York.

*Reg. Trade-mark of General Electric Co.

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

# NOW ...FOR

## *Utility Companies*

The new, space-saving R-A Silicon Rectifier is designed for continuous operation in an ambient temperature of 50°C with standard grade transformer oil used as coolant. Construction includes transformer with tap switches for ±2% voltage adjustment, multiple windings for diode balancing plus balancing reactors for equalized parallel diode operation; current-limiting, fast-breaking fuses for diode protection against external or internal conditions.

Simplified servicing construction makes possible replacement of rotary converters (or any other type of DC producing equipment) by connecting in parallel without additional balancing devices and connecting directly to standard DC network systems.

Richardson-Allen's advanced engineering laboratories designed and built the new R-A Silicon Rectifier, the *FIRST* and only one of its kind, to meet the utility companies' problem of rendering service to their DC users. The space-saving, high-efficiency R-A Silicon Rectifier answers the problem economically and meets the most demanding, rigid requirements. It is the *FIRST* rectifier to answer the problem.

The new R-A Silicon Rectifier can be designed and built by Richardson-Allen's engineers in a wide range of capacities to meet your individual requirements.

# THE FIRST TIME

## *can have AC-DC Conversion with* **SILICON** *in Capsule Compactness at a fraction of normal costs!*

Richardson-Allen Corporation's new, high-efficiency space-saving silicon rectifier is the FIRST to give utility companies these wanted features:

- **...designed for street vault installation–only 83" long x 45" wide x 85" high**
- **...gives 98% efficiency at full load**
- **...eliminates costly substations and transmission lines**
- **...permits serving DC customers while installing new, more demanded AC power**
- **...eliminates any installation on customers' premises**
- **...delivers DC power at required points**

The new R-A Silicon Rectifier, already in utility company service, provides these performance-proven features:

- **...silicon rectification–full wave bridge connected**
- **...5% regulation with constant line voltage**
- **...4.5% ripple across outside legs**
- **...DC output of 120/240 volts, 1,000 amperes, 3 wire**
- **...AC input of 208 volts, 3 phase, 60 cycles, 4 wire**
- **...submersible construction, seam welded to withstand 7 p.s.i.**
- **...constructed of 1/2" and 5/16" steel plate**
- **...air tight fuse box**
- **...and, no moving parts insures long, trouble-free performance**

*For further details, write today to:*

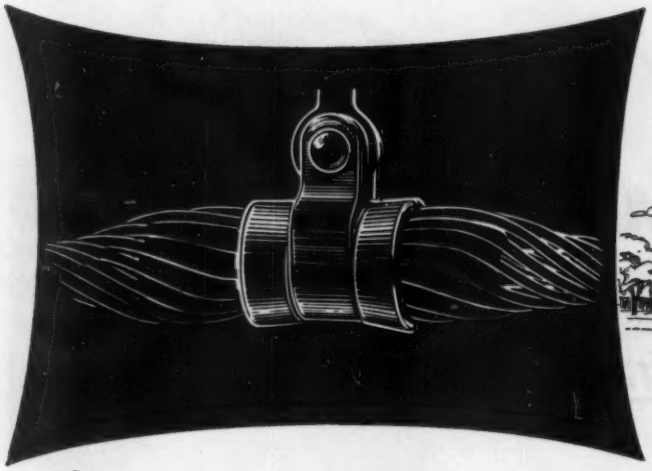
**RICHARDSON ALLEN** *Corporation*

**DEPENDABLE RECTIFIER SPECIALISTS**

R A

a Manufacturing affiliate of WESLEY BLOCK & CO., INC., 116-18 Fifteenth Ave., College Point, N. Y.

IN CANADA: Richardson-Allen of Canada, Ltd., 1296 Birchmount Rd., Scarborough, Ontario



# "PERFECTING not PERFECTION is our goal" *

**Yesterday's answers are not good enough. Today's will need improving tomorrow.**

**Take the problem of vibration fatigue. Failure of strand because of vibration or galloping does not occur in mid span. But it becomes a real problem at points of stress concentration, such as the end of the clamp keeper—at mass concentrations, such as at clamps, dampers and rigid splices—or at wearing points at loose attachments or fastenings.**

**Yesterday's answer**—PREFORMED ARMOR RODS introduced by Preformed Line Products Company in 1947.

**Today's answer**—PLP PREFORMED ARMOR with pitch direction the same as conductor strand and pitch length less than that of strand (Patent No. 2,609,653). When used in conventional clamps:

- it extends uninterrupted conductor life
- it eliminates wear possibilities
- it prevents excessive mass and stress concentrations.

**Tomorrow's answer** is here today: the armor rod principle carried one step further in Preformed's ARMOR-GRIP SUSPENSION (Patent No. 2,722,393), the entirely new concept in suspension design.

The Armor-Grip Suspension Unit is a "floating suspension"—the conductor is cradled in neoprene and firmly gripped only by the custom-designed Preformed Rods which distribute their pressure over a relatively large area. The result: no wear possibilities—no mass concentrations—*and no clamping stress concentrations.*

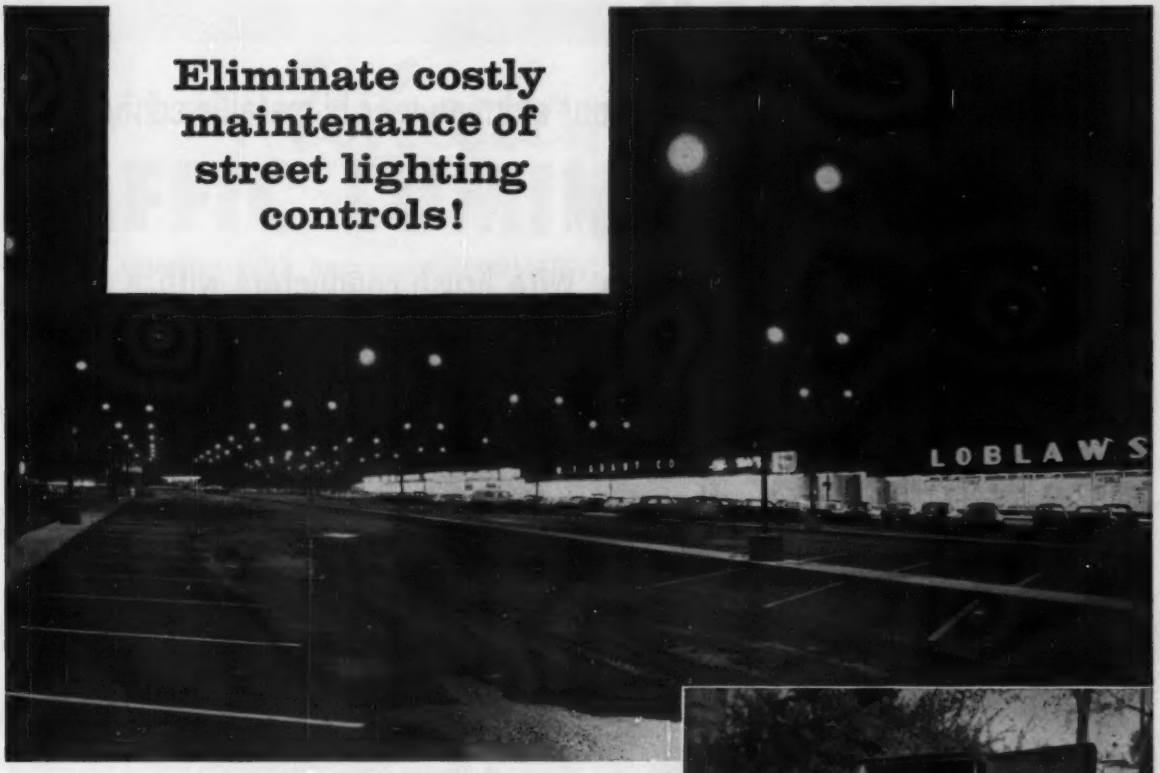
This is another example of PLP research laboratories at work. Ever improving methods, materials and solutions is our goal. Call a PLP Representative today and ask for a demonstration.

* *John Dewey, "The Reconstruction of Philosophy"*

*Made in accordance with or for use under one or more of the following U. S. Patents: 2,722,393; 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.*

PLP

# Eliminate costly maintenance of street lighting controls!




## SANGAMO TIME SWITCHES automatically compensate for daily changes in time...require no resetting after power failure

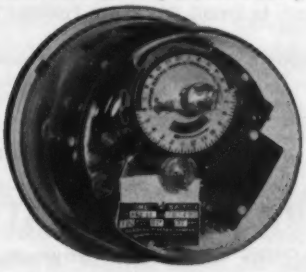
Maintenance costs go down when your street lighting is controlled by Sangamo Time Switches. They require little or no attention and provide unfailing on-off operation.

Sangamo Type WSZ socket type time switches are first choice of many street lighting engineers. The *socket mounting* means easy installation—quick replacement.

The *astronomic dial* automatically compensates for daily changes in operating time—all year 'round. The *automatic carryover* keeps the switch running on time for up to 10 hours if the power fails—no resetting is necessary. The carryover is electrically rewound after use.

Ask your Sangamo Representative to give you full information about this cost-cutting method for your street lighting.

This installation, in a large midwestern city, shows a Sangamo Type WSZ Switch used for sectionalized street lighting control. The load is carried by contactors activated by the switch. One WSZ Switch thus controls 6 to 8 blocks.



ST57-4

**SANGAMO ELECTRIC COMPANY**
SPRINGFIELD, ILLINOIS

# WHY WORRY about aluminum or bi-metallic connectors?

DO THIS ▼▼▼

**1.** Wire brush conductors with a...

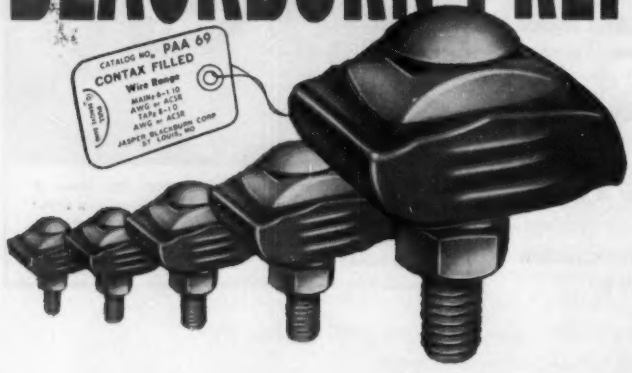
# BLACKBURN WIRE BRUSH

## with exclusive GLOVE GUARD

- Exclusive guard prevents glove puncture
- Easy grip handle and guard completely covered with durable thermo-plastic coating
- Brush elements can be rotated and are replaceable
- Number WBH-2 furnished with hot line tool adaptor
- Competitively priced

**2.** Use...

# BLACKBURN PREFILLED CLAMPS




## PAA, PAC and PGP LINES

Contax liberally applied to each groove at factory, then sealed in. Catalog number and wire range printed on tag. Just wire brush conductor—pull tear string—cover drops off—clamp ready to install. Blackburn Prefilled Clamps save installation time—give you positive assurance compound is always applied to connections.

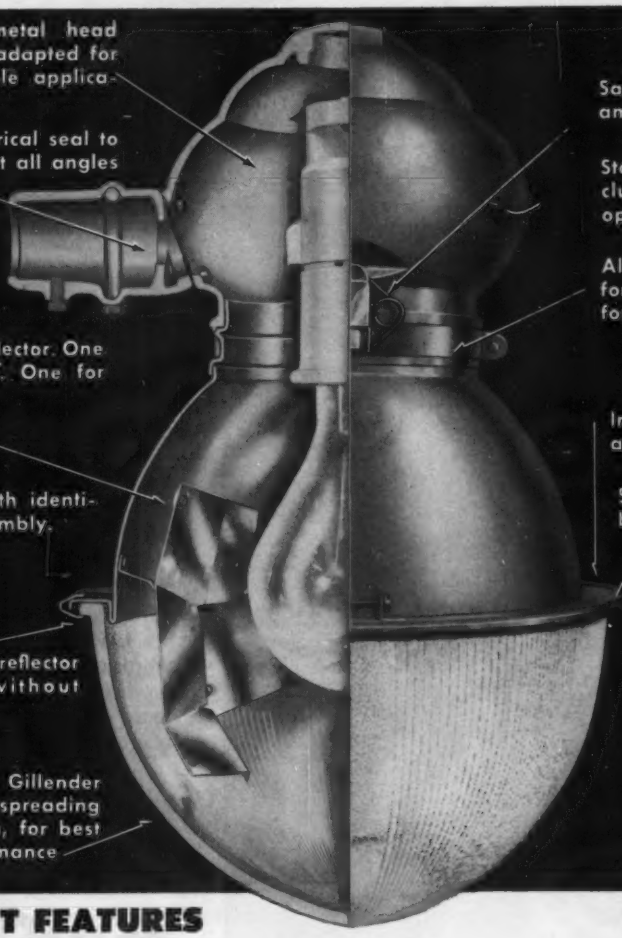
*Available through electrical wholesalers everywhere*

**JASPER BLACKBURN CORPORATION**

1525 WOODSON RD., ST. LOUIS 14. MO., WYdown 3-9430

# NEW! from *Wheeler*
# TRAFFIC LUMINAIRE

**Basic street lighting with improved SIMPLICITY, CONTROL and EFFICIENCY . . . all combined in new enclosed type Wheeler Traffic Luminaire from 2,500 to 11,000 lumens — available in I.E.S. types I, II, III, IV and V.**



Large EEI-NEMA metal head with white interior adapted for all series or multiple applications.

Slip fitter with spherical seal to close end of pipe at all angles of adjustment.

High efficiency shieldflector. One for types III and IV. One for type II.

Domed nameplate with identification of optical assembly.

Tight joint between reflector flange and globe without gaskets.

Corning Refractor, or Gillender diffusing globe with spreading flutes in lower region, for best overall optical performance

Safety-pin latch spring gives ample strength and deflection.

Stainless steel safety chain included with all clamping band optical assemblies.

All heads and reflectors conform to EEI-NEMA standards for interchangeability.

Index arrow to align refractor axis with shieldflector.

Stainless steel globe clamping band

Optional construction.

Roller latch and hinged globe attachment for operation by stick or lamp puller.

## IMPORTANT FEATURES

### *NEW* EFFICIENCY!

**Alzak aluminum reflector extends down inside globe, salvaging light formerly lost in globe lip and clamping band.**

### *NEW* CONTROL

**Floating neck construction to adjust orientation of optical assembly in accordance with street configurations.**

### *NEW* STOCK SIMPLIFICATION

**All five I.E.S. standard light distribution patterns obtainable with combinations of the basic reflector plus the following 4 optical components:**

- **One Corning refractor**
- **One Diffusing globe**
- **Two Shieldflectors**

## Bright Idea

**Write for traffic luminaire bulletin 2-20— just off the press.**

**Wheeler Reflector Company**
(Div. of Franklin Research Corp.)
275 Congress Street
Boston 10, Massachusetts

*"Alcoa" starts with this...*

*to make*

# Long-lived, lightweight service drop

Photos courtesy of Aluminum Company of America, Pittsburgh, Pa.

Right from the start, "Alcoa" triplex service drop is engineered for easy installation and low maintenance. Its two conductors have an extruded covering of BAKELITE Brand Polyethylene.

This is a uniform, lightweight, weather-resistant covering. It is tough and flexible, and will not festoon. It permits longer spans, faster stripping and splicing, easier handling.

BAKELITE Polyethylene provides the same advantages when used on line wire and control cable. It is top-quality material, formulated specifically for these jobs by the company with the longest experience in plastics. For technical data on BAKELITE Brand Polyethylene and names of wire manufacturers who use it, write Dept. ZO-53.

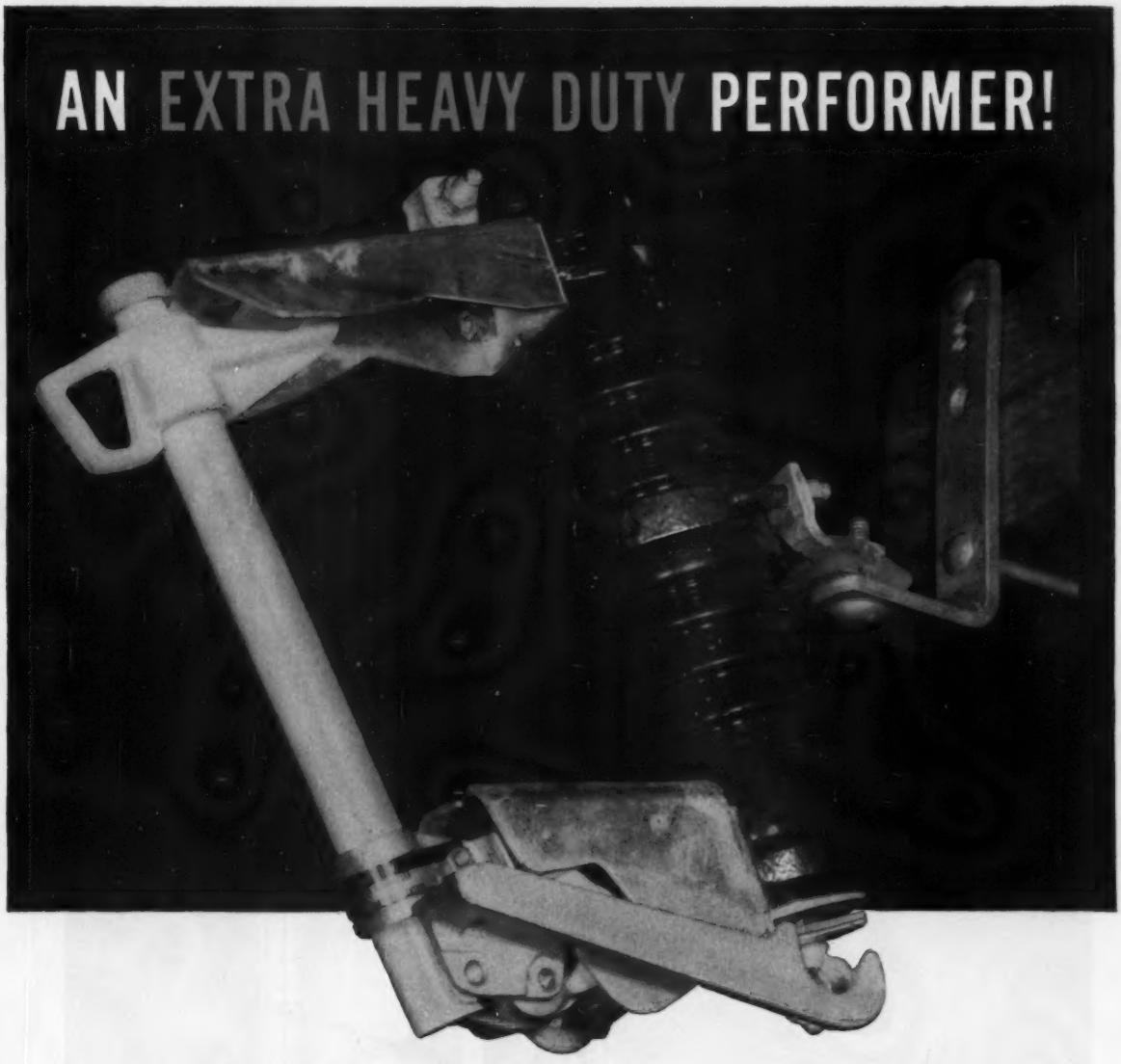
**BAKELITE**
BRAND
**PLASTICS**

**UNION CARBIDE**

**BAKELITE COMPANY,** *Division of Union Carbide Corporation,* 30 East 42nd Street, New York 17, N. Y.

The terms BAKELITE, UNION CARBIDE and the Trefoil Symbol are registered trade-marks of UCC.

# AN EXTRA HEAVY DUTY PERFORMER!



## 10,000-amp interruption conclusively PROVED in the High Power Lab!

To provide the *extra* measure of protection so vital on your growing distribution lines, Westinghouse has extended the capacity of its time-proven line of open fuse cutouts. The Extra Heavy Duty "DX" cutout not only interrupts faults of 10,000 amperes safely and dependably, but will do it time and time again . . . without failure!

Under the worst field conditions, simulated at the Westinghouse High Power Laboratory, the new Extra Heavy Duty "DX" cutout was given the thorough kind of workout that assures you of reliable circuit protection on 5.2, 7.8 or 15 kv lines . . . with 100-amp continuous rating. A rugged load-break device, shown above, is available for economical switching of lines under full load.

For further information on the improved "DX" cutout, contact your Westinghouse Sales Engineer, or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60936

YOU CAN BE SURE...IF IT'S Westinghouse

*When the weather's bad you can say . . .*

# today's the day to work on Shelterfor-M*

Extensive floor space inside the shelter area allows crewmen to pass two breakers past one another.

Cold, rain, snow or sleet . . . your crews can work *inside* on *outdoor* switchgear when you have Westinghouse Shelterfor-M. No longer is it necessary to hang canvas tarps and build make-shift shelters to work on breakers, instruments or relays when the weather is bad. In fact, maintenance men *use* the wet weather to work in the new Westinghouse metalclad switchgear . . . and save the pleasant days for the regular exposed-to-weather installations.

Roomy interior of the Shelterfor-M switchgear allows instrument panels to swing wide for front drawout of breakers for inspection and testing. Two breakers can be passed, side-by-side, even with the doors open wide, inside the covered passage-way.

You also get the many outstanding features of standard Westinghouse switchgear: undercoating, multicoat painting and Bonderized finishing, to eliminate rust and corrosion. Exclusive Redarta® flame retardant insulation. Jig-welding construction for interchangeability of like-rated breakers.

For complete information call your local Westinghouse sales engineer or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-60924

*Shelterfor-M . . . shelter for maintenance

**YOU CAN BE SURE... IF IT'S Westinghouse**

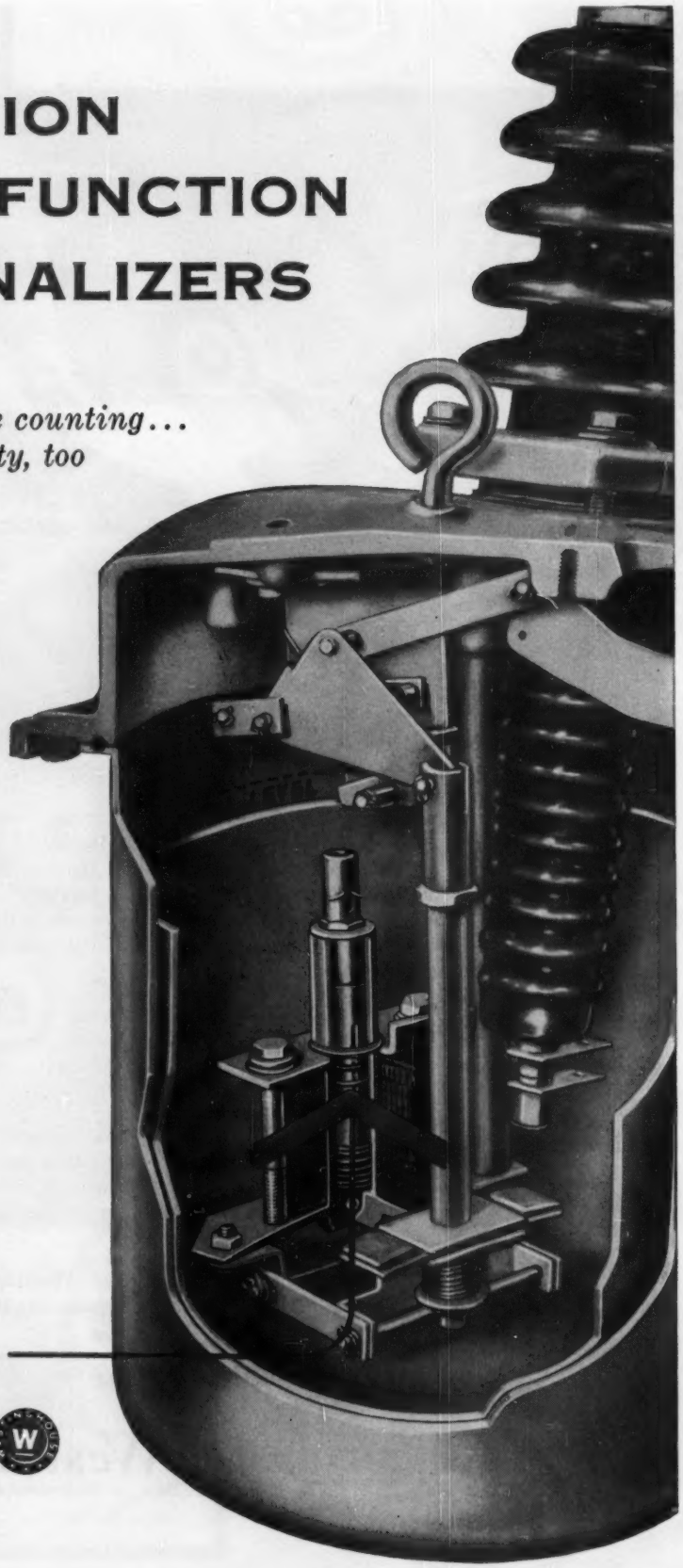
# COORDINATION IS A PRIME FUNCTION OF SECTIONALIZERS

*Only Westinghouse gives you absolutely precise counting... and greater current capacity, too*

By definition, a sectionalizer is an automatic switch which works in conjunction with power circuit breakers and reclosers to isolate local, permanent faults and thereby protect system service continuity. Its ability to coordinate with breakers and reclosers is therefore a paramount factor in evaluation.

Westinghouse sectionalizer coordination is positive. The Westinghouse sectionalizer will carry more than 50% greater current, continuously, and will accept momentary leads up to 6500 amperes. The Westinghouse Type GRS line is the most complete—nine current steps from 5 through 140 amperes—and voltage ratings to 15 kv.

Complete details are available from your Westinghouse sales representative. Also, you may write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania, for reprint No. 5090, an application and engineering AIEE paper on sectionalizer coordination concepts. J-60923

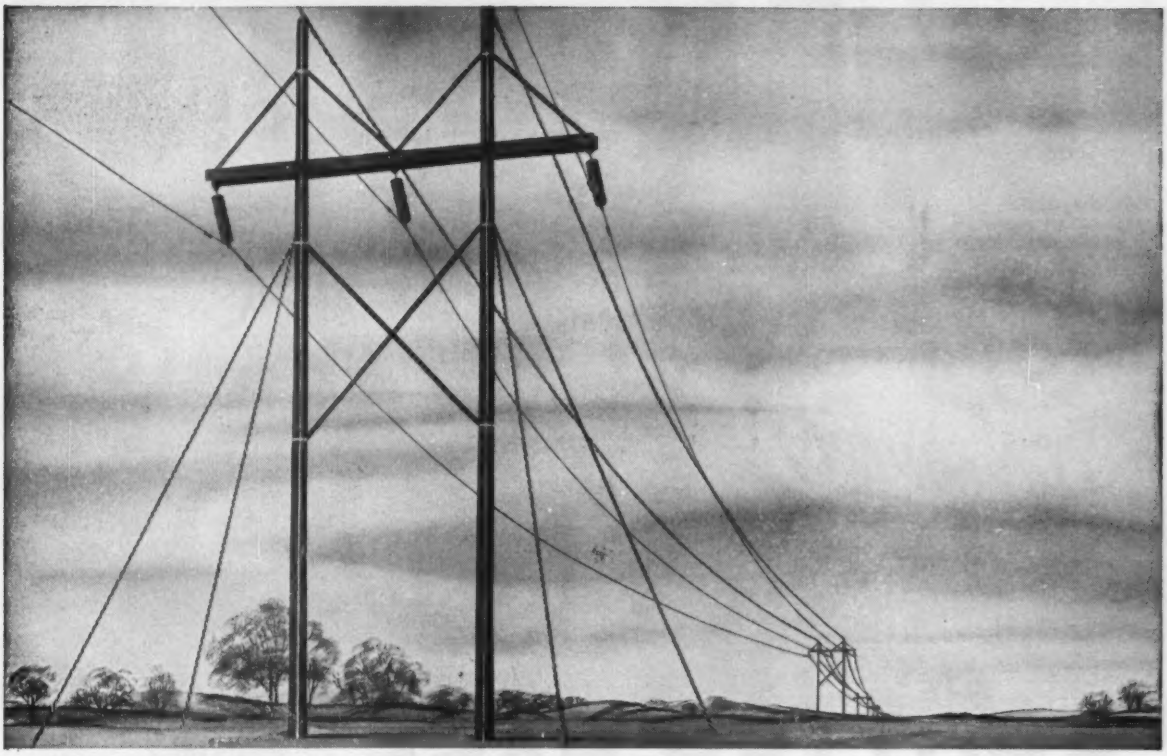


Consistent and accurate counting is assured by the patented magnetic rings in the integrator mechanism. During operation, the brass integrator piston is locked in each counting position by the magnet plate on top of the series coil.

YOU CAN BE SURE...IF IT'S

Westinghouse

# CF&I GALVANIZED STEEL STRAND



## made in the east and the west for prompt delivery

East or West, there's a single, convenient source of top-quality galvanized strand for ground, messenger and guy wire. That's because dependable time-proved CF&I Galvanized Strand* is produced at both Buffalo, N. Y., and Pueblo, Colorado.

This combination of plant sites enables CF&I to quickly and efficiently fill your strand requirements.

What's more, you're always sure of the quality of CF&I Galvanized Strand. Every phase of its production is handled by the makers of world-renowned Wickwire Wire Rope and Wire Rope Slings...every phase of its production is under CF&I's rigid quality control system.

Next time you need strand—whether it's to ASTM Specification A-122, A-363 or your specification—it'll pay you to contact the closest CF&I sales office listed below.

*three- and seven-wire constructions

WICKWIRE A CF&I PRODUCT

**GALVANIZED STEEL STRAND**

**THE COLORADO FUEL AND IRON CORPORATION**

CF&I

Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Chicago • Denver • Detroit • El Paso • Ft. Worth • Houston • Kansas City Lincoln (Neb.) • Los Angeles • New Orleans • New York • Oakland • Oklahoma City • Philadelphia • Phoenix • Portland • Pueblo • Salt Lake City San Francisco • Seattle • Spokane • Wichita • CF&I OFFICES IN CANADA: Toronto • Montreal

4247

# HIGHWAY

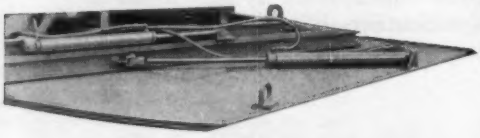
*Announces*

## THE SPOTTER-BASE for Highway Skid-Mounted Earth-Boring Machines

**. . . hydraulic positioning in an 80" arc, extends 22"**
**. . . digs holes 9" to 36" in diameter up to 10 feet deep.**

*Hydraulic positioning*

A hydraulic positioning ram controls auger travel across the rear of the truck body.



The Spotter-Base is your answer for versatile, fast, easy digging. This unit spots the hole, eliminating constant maneuvering of the truck during digging and pole setting operations. The Spotter "reaches" over digging obstructions and can shift digging direction should an underground obstacle be encountered.

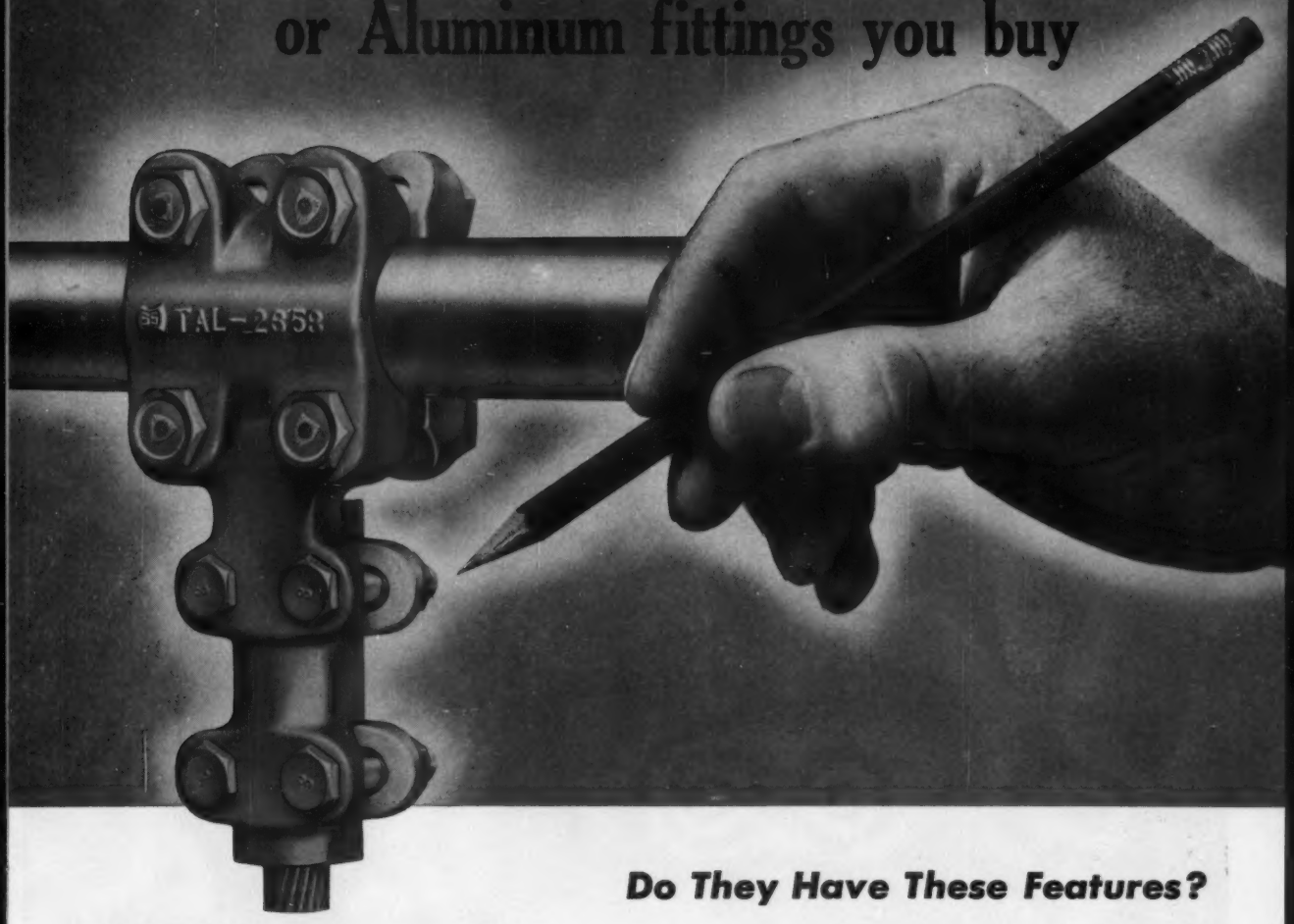
Finger-tip controlled hydraulic positioning allows the operator to position the boring machine within an arc of 80 inches — and extend the unit 22 inches from platform. The Spotter will dig at any point within this arc and within the forward and aft traverse. The boring head and intermediate case are equipped with a leveling mechanism. This is combined with the new Spotter-Base to provide extreme digging flexibility. The Spotter can be mounted on a single axle or tandem truck.

HIGHWAY

A Division of Merritt-Chapman & Scott Corp.

UTILITY DIVISION
**HIGHWAY TRAILER COMPANY**
HEADQUARTERS: EDGERTON, WISCONSIN
Manufacturers of: Public Utility Bodies • Earth-Boring Machines • Pole and Cable Reel Trailers • Winches • Power Take-offs • Service Accessories • Commercial Trailers • Trailerized Tanks and Dry Bulk Haulers
SALES AND SERVICE IN PRINCIPAL CITIES

# CHECK POINTS for the Bronze or Aluminum fittings you buy




## Southern States Connectors Meet Every Single Requirement

Never underestimate the importance of a good connection!

A faulty connection can mean trouble and cost you money!

The failure of any connector, no matter how insignificant, can cause a circuit interruption as surely as any major system component. That's why it pays to select the fittings for today's heavily loaded systems with a great deal of care.

Take a look at the check list at right. If you can't answer "yes" to these questions, then the fittings going into your system may be inadequate.

Southern States bronze and aluminum fittings meet every single requirement listed.

For complete information write for catalogs describing Southern States' complete line of bronze and aluminum fittings.

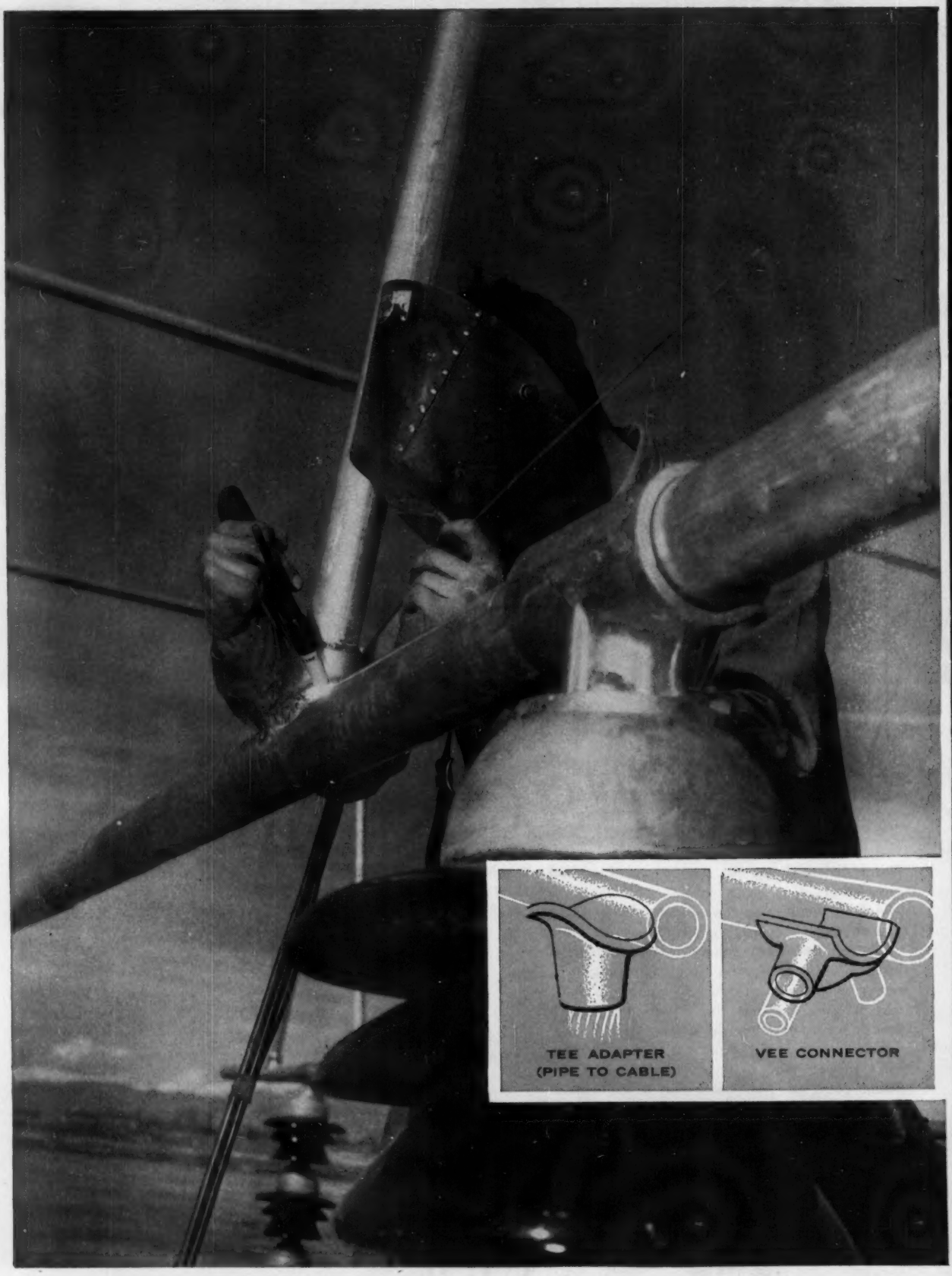
## *Do They Have These Features?*

| | YES | NO |
|---|---|---|
| Are they structurally strong enough to prevent pull-out of conductors? | ☐ | ☐ |
| Are stress points rugged with cross-sectional strength to spare? | ☐ | ☐ |
| Are bolt heads recessed for single-wrench assembly and disassembly? | ☐ | ☐ |
| Do contact surfaces accurately match curvature of conductor? | ☐ | ☐ |
| Are contact surfaces finished to provide multi-point engagement with conductor? | ☐ | ☐ |
| Are castings fine grained, with smooth pit-free surfaces? | ☐ | ☐ |
| Are contact surfaces extra-large to provide maximum engagement? | ☐ | ☐ |
| Are bolts of standard size and thread for ready replacement from local sources? | ☐ | ☐ |
| Is the over-all appearance of the connector pleasing and not excessively heavy? | ☐ | ☐ |
| Do they meet NEMA standards in every respect? | ☐ | ☐ |

LIVE BETTER ELECTRICALLY

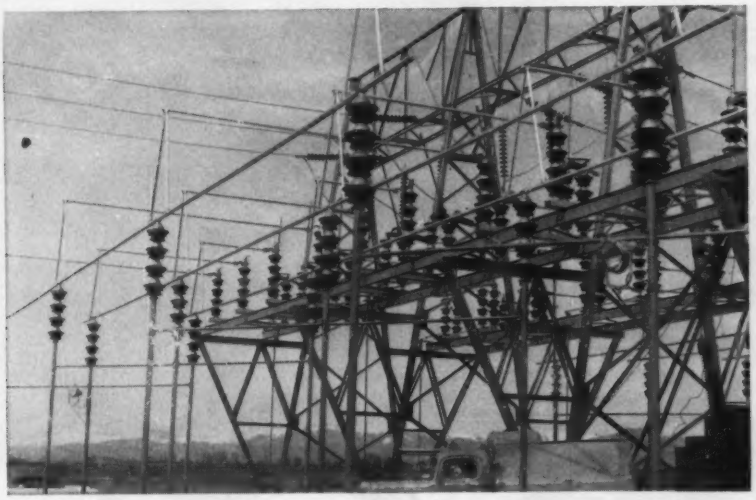
IN CANADA: Dominion Cutout Co., Ltd., Toronto

**SOUTHERN STATES**
**EQUIPMENT CORP.**
HAMPTON, GEORGIA

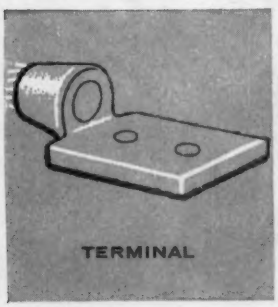

TEE ADAPTER
(PIPE TO CABLE)
VEE CONNECTOR

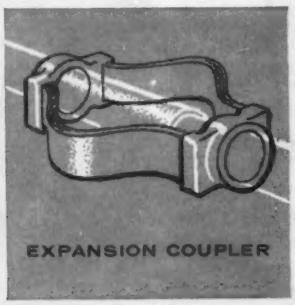
# THERE'S AN ALCOA WELDED ALUMINUM BUS FITTING FOR EVERY APPLICATION

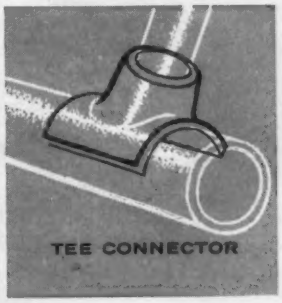
◀ Aluminum fittings permanently positioned with inert-gas welding are installed by one man. Joints are rigid; no extra bracing required.



▲ Tubular bus and standard welded fittings in this substation provided savings in installed cost as well as a stronger and better looking bus assembly.




Ever since Alcoa introduced welded aluminum bus construction over 10 years ago, the electrical industry has been realizing ever-increasing savings in those installations where many joints, taps and supports are required.

Welded aluminum fittings are quick and easy to install and give a compact and neat appearance. They are mechanically strong, electrically sound, corrosion resistant, and their proved durability cuts maintenance to a minimum.

Alcoa research and development have made available a complete line of welded aluminum bus fittings to meet every variety of application. Consider their advantages for your next installation. Full information may be obtained from your Alcoa electrical conductor salesman or the Alcoa sales office in your area. Aluminum Company of America, 2306-K Alcoa Building, Pittsburgh 19, Pa.

NEW! "ALCOA THEATRE"
Exciting Adventure, Alternate Monday Evenings

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

*Nicopress Sleeves and Tools Patented in U.S. and Foreign Countries. "Nicopress" Registered in U.S. and Foreign Countries.*

**The National Telephone Supply Company**

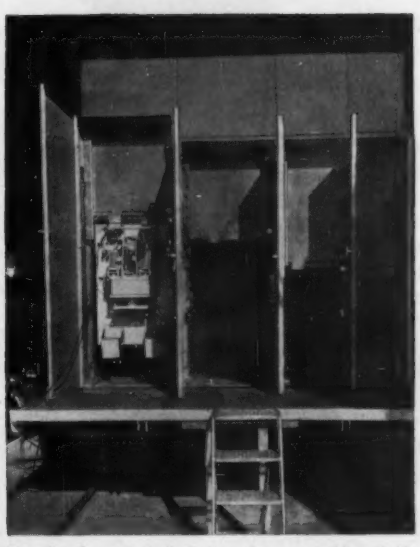
**5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO**

Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

A test bay at the Switchgear Development Laboratory is the scene of periodic quality-control testing of production-line Magne-blast breakers in standard enclosures. Design changes are also tested here under operating conditions.



Standard metal-clad housings enable G-E engineers to test breakers under field conditions. The housing accommodates the full line of Magne-blast breaker ratings.

# TESTING...

## under actual -- **not simulated** -- conditions

Circuit breakers for metal-clad switchgear *can* be tested outside their enclosures, but performance may differ considerably when the unit is installed in its metal-clad housing. That's why General Electric engineers have devised a method which permits testing with the Magne-blast breaker *actually installed* in a metal-clad housing.

During these tests, breakers are subjected to impulse, fault current, and other tests at full rated interrupting capacity. The tests, and the careful evaluation of their results, are another example of the engineering skill which is constantly at work to improve the performance of General Electric Metal-clad Switchgear.

For complete details about the "plus values" of G-E Metal-clad, contact your Apparatus Sales Office or write to Section 511-21, General Electric Company, Schenectady 5, New York.

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

# Theory Plus Practice



**Lord Kelvin:**

First, the pure theory—applied without delay to practical inventions: this was the tenor of Lord Kelvin's outstanding work.

Following his "Law of Squares" in 1853 he perfected the curb transmitter, which overcame the retardation of signals in long-distance cables.

From Lord Kelvin's theory plus practice, more than a century ago, stem today's advances in communications.

For over a century, Kerite theory and practice has proved that Kerite is the most lasting cable known. More than three generations of Kerite craftsmen have given of their inherited skill to assure the long life and service of Kerite Cable. The Kerite Cable Company takes pride in the fact that their product is chosen by buyers of integrity to safeguard installations around the world.

***The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.***

Founded 1854

# KERITE CABLE

**THE KERITE COMPANY—30 Church St., New York 7, N. Y.**
**Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco; 3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston; 4101 San Jacinto, Houston 4, Texas; 1010 Euclid Avenue, Cleveland 17, Ohio; 29 West Lancaster Avenue, Ardmore, Pa.**

# EDITORIALS

## ". . . The Race Is Not to the Swift . . ."

Government mandate has settled the question of whether the United States nuclear energy program needs a gas-cooled reactor of the British Calder Hall type. Congress has directed the Atomic Energy Commission to proceed with the design of a natural-uranium fueled, gas-cooled, graphite-moderated electric power plant of 40 Mw electrical capacity.

Certainly any controversy about the practicability such a venture is best settled by trying it out. This the government intends to do. With this we have no quarrel.

But the time table under which this reactor concept is to be developed leaves much to be desired. Invitations to bid on the job of designing this gas-cooled reactor plant were sent out last August 31 with the deadline for proposals set for late September —less than one month later.

AEC in turn must report back to Congress on the design, with cost estimates and a schedule of construction, not later than April 1, 1958. That's just six months from now. This means that the firm that gets the design contract will have less than six months to complete its design.

In view of the work already done on this design by the British, this should be enough time to finalize a design based on British practice. But if we are to make a contribution in the field of natural-uranium, gas-cooled reactors this is certainly not enough time to investigate new concepts.

The British spent some 2 years developing the design for their gas-cooled reactor. We spent an equal amount of time developing the pressurized water and boiling water types.

Surely we should spend more than six months perfecting our version of the gas-cooled reactor. Time for more research in fuel cladding and gas coolants might well result in higher temperatures being used. The possibility of using larger cores, if investigated, would probably enable us to build bigger units with a consequent decrease in per kw cost. The effect of slightly enriched uranium on the gas-cooled reactor type also merits investigation.

Government mandate has answered the question "Should we consider a gas-cooled reactor?" Certainly the world knows the British pioneered the gas-cooled reactor. There is little to be gained by telling the world—"We can build one too." But since we are committed to the task of designing one, it should be the best our present knowledge will permit. A crash program, permitting only six months for complete design, seems to be unreasonable. We need enough time to make a major design improvement.

## Why Energy Costs Differ

The difference in the cost of energy produced by private utilities and public power agencies has always been a subject of interest. We have had the opportunity for comparing these costs in our recently published Tenth Steam Station Cost Survey.

As reported in the survey, cost of energy at the busbar varies from a high of 9 mills per net kwhr to a low of 3 mills per net kwhr. Plant size, load factor, plant location, and investment charges were the main factors affecting cost.

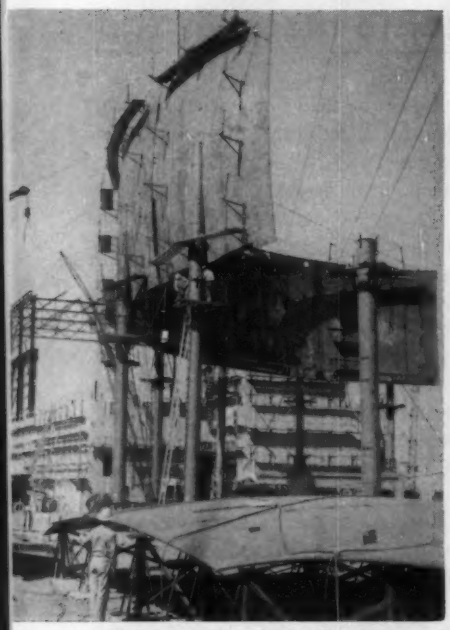
Plant size and load factor are dictated by system requirements and there is very little management and engineering talent can do once requirements have been established. Area-plant location is also beyond the control of management. If a company is in a low cost fuel area, it is fortunate; if not, there is very little that can be done about it.

Private utilities and their consultants and public utilities and their consultants have both displayed excellent engineering talent in taking these factors into consideration when designing and building power plants.

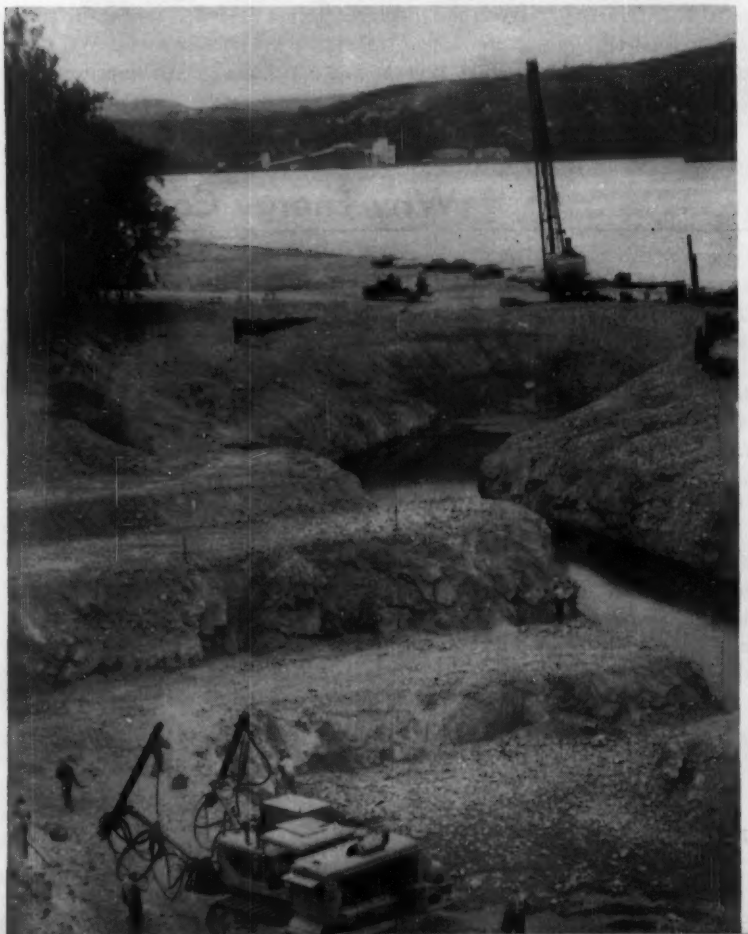
It is only in the area of plant investment charges where any great difference occurs. The survey shows that the percentage used by private utilities in computing annual investment charges ranged from 11 to 17.5%. The comparable figure reported by public power agencies was from 2.8 to 7.5%.

Obviously this is the core of the cost difference between the two. Cost of money and tax advantages are reflected in these figures. And as long as these differences remain there will be a difference in the cost of producing power in public and private power plants.

# Construction Progresses on U.S.



DRESDEN workmen install sections of the 190-ft steel sphere that will house the Dresden, Ill., boiling water reactor. Started last June, Commonwealth Edison Co's 180-Mw nuclear station will be the largest power reactor in U. S.



INDIAN POINT drilling machine is on the lip of depression where condenser will be installed. Superheaters will go on hill at left and pressurized water reactor will be atop the hill. The Consolidated Edison Co plant will produce 236 Mw. Water in excavation is held in a discharge tunnel which will be cut through to Hudson River. Across river is Rockland L&P's Lovett Station

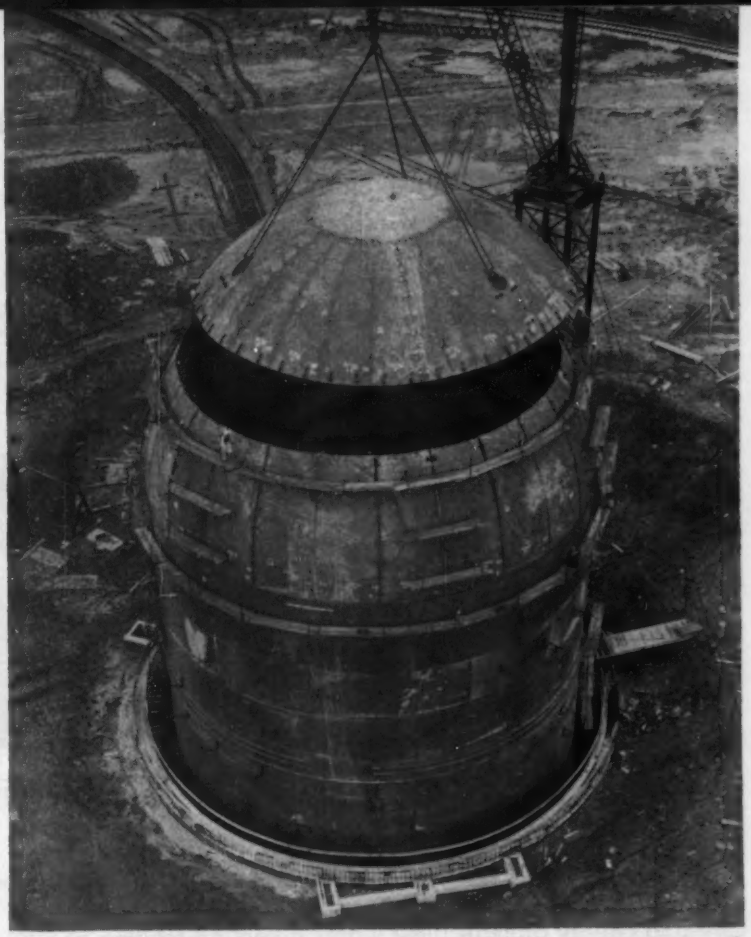
SHIPPINGPORT nuclear core is lowered into container of Duquesne Light Co's 100-Mw plant (left photo). Fuel handling canal has a temporary reactor test head in pressure vessel (bottom, right photo). Fuel assembly manipulator (top) automatically removes under water any of 145 fuel assemblies from core. Assemblies move through canal to storage pit for radioactive cool-off period

# Atom Plants

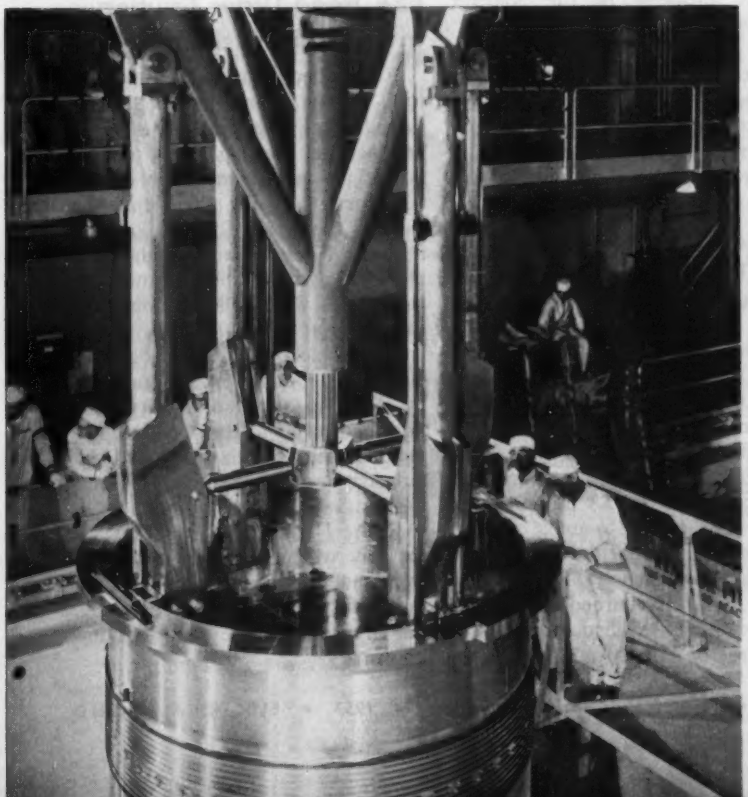
Another important milestone in U. S. nuclear power development took place October 5 at Shippingport, Pa. Engineers and technicians of Duquesne Light Co and Westinghouse Electric Corp's Bettis atomic power division delicately lowered the 58-ton pressurized water reactor's nuclear core into a stainless steel container (photo below).

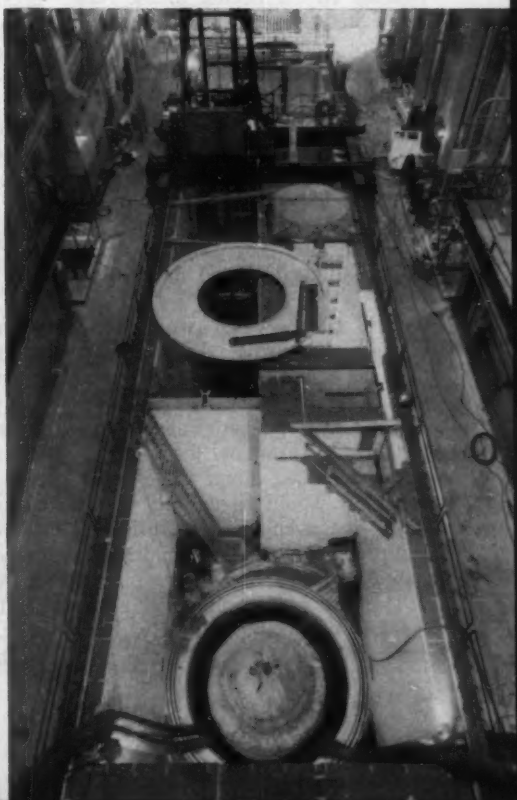
The core's fission process will heat high-pressure water which then will turn a second supply of water into steam. Steam will drive a 100-Mw turbine-generator in the world's first full-scale atomic station serving civilian needs.

Meanwhile, at installations shown here and other nuclear plant sites the industry's projects are taking form. But due to mounting costs of material, research and development, and design change, the going is getting tough. One casualty, a plant proposed by Wolverine Electric Cooperative, has been postponed and the co-op-backed Elk River, Minn., plant delayed because of increased construction estimates.



**ENRICO FERMI fast breeder reactor containment building gets capped with 35-ton steel crown. Capsule rises 70 ft high, extends 50 ft underground, has 415,000 cu ft volume. The Power Reactor Development Co plant is 100-Mw**





# Financial Seminar Broadens Management View

**Iowa-Illinois G&E meeting explores the 'why's' and 'how's' of financing for its officers, managers, and their assistants**

A one-day seminar on the financial aspects of utility management has helped broaden Iowa-Illinois Gas & Electric Co managers' understanding. The session, backed by a program of study and research, took place late last month. It substituted for a regular weekly staff meeting.

The seminar consisted of papers presented by company officers, staff directors, department and district managers, and their assistants. These were followed by general discussion and questions.

Views expressed were those of the participants. The papers did not necessarily reflect in detail the policy or views of management. "However," observed Pres Charles H. Whitmore, "the management considers these presentations are excellent and show thought and perception of a very high order."

### Panels Examine Financial Picture

Set up in four panels, the seminar explored capital ratios and the cost of capital, investors' views of utility common stock and obtaining common equity, an economic analysis of plant investment, plans for financing the company's three-year budget, and the firm's relationship to the United States' system of free enterprise.

On the free enterprise relationship, Treasurer R. H. Tinsman stressed a "corporate combination of capital, labor, and management." The company's prime objective—good service—is of double importance, he said. First, "good customer relations is good business. In the second place the public utility is the front line trench in the battle against those who would scuttle our system in the nebulous search for a socialistic Utopia."

## WASHINGTON WIRE

# Dispute Delays Niagara Trial

**City and county officials blast water diversion scheme at FPC hearing; NYPA's construction costs questioned**

The Federal Power Commission hearing on the license to the New York State Power Authority for the Niagara Falls hydroelectric project is dragging despite efforts to speed it.

The City of Niagara Falls, the towns of Niagara and Lewiston, and the county of Niagara show no inclination to back down on their demands that certain phases of the project be changed.

Specifically, they want the diversion conduits tunneled in place of NYPA's proposal for a "cut and cover" canal which would pass through the towns. And they are opposed to the size of the proposed storage reservoir.

The City of Niagara Falls told the FPC hearing examiner the construction would last about three years. The work would disrupt city traffic, cause inconvenience to residents, and present a hazard to children, its spokesman said.

The city also complained about the loss of taxable property, both through land removed by the proposed canal and through loss of the taxable property of the Niagara Mohawk Power Corp.

To accommodate the power authority's demand for speed, FPC had issued a partial license for the project before holding a public hearing on the license. The hearing is concerned with the conduits and the reservoir which remain unauthorized.

### 'Fantastic' Tunnel Estimate

NYPA contends that to tunnel will add $200 million to the cost of the project. The opposing communities say this is "fantastic." At the most, they figure, the additional cost will be $55 million.

Before the hearings began, NYPA had offered to pay the City of Niagara Falls, Niagara County, and the city school district $3 million over a five year period to make up for tax losses caused by the destruction of Niagara Mohawk's Schoellkopf plant. The city turned down the offer. It hopes, instead, to obtain a surcharge of 15/100 mill per kwhr, or a total of $2 million annually.

At the request of the communities, the hearing now has been adjourned until Oct. 21 so that they can bring forward their own experts to dispute the testimony of the power authority.

## REA Head Urges Caution in Entering Nuclear Field

Rural Electrification Administrator David A. Hamil last week cautioned rural electrification borrowers against rushing into nuclear power at the present stage of development. At the same time he assured them that REA is keeping abreast of development in the field and will bring nuclear power to rural areas when it is economically justified.

Hamil kicked off a two-day nuclear power conference, sponsored by REA, to bring rural electrification leaders up to date on developments in the field via speakers from industry and Atomic Energy Commission.

REA, Hamil said, hopes to see the day when electricity produced from nuclear fuels will result in lower cost power for rural people, but at present these costs are unknown.

**As end of the hydro era approaches . . .**

# Pacific NW Looks to Thermal Plants

About one-third of the loads forecast for 1985 in the Columbia River Basin will be supplied by thermal generation. In the year 2000, thermal plants will produce about two-thirds of the region's power needs.

These are conclusions drawn from preliminary findings of the North Pacific Division, Corps of Engineers. The division will hold four public hearings this month and in November before preparing its review report for comprehensive development of the basin's water resources. The complete review is scheduled to appear in June, 1958.

### Says Load Can Be Met to '65

Power studies of the current investigation indicate that load requirements for 1965 can be met by addition of hydro projects now under construction or scheduled for early construction, said Brig Gen. L. H. Foote, North Pacific Division.

The power system serving the Pacific Northwest apparently will change in the next 40 years from substantially an all-hydro system to one supported largely by thermal generation, the forecast stated.

According to power company observers, the 1960's is the Northwest's most critical period. Unless new dams are started soon, they say, there's bound to be a shortage.

### 500-Mw a Year Needed

By 1964, peak load for the Northwest is expected to be some 13.5-million kw, or an increase of 5.8-million kw over current load. This means 500,000 kw or more of generating capacity must be built each year if the fast-growing region is to have adequate power.

Projects underway such as Portland General Electric Co's Pelton hydro plant (above) or ones definitely scheduled will produce 3.6-million kw by 1963-64.

A partnership approach to 36 out of 70 suggested projects in the region would provide an additional 6.7-million kw of capacity by 1963-64, the spokesmen say.

The impact of high interest rates has already been felt by municipals, public utility districts, and companies that have financed projects in the past two years. The higher rates and spiralling wage and material costs have edged new hydro generation estimates up to about five mills per kwhr. Steam power for the area is produced at a cost of six to seven mills/kwhr. The narrowing spread between hydro and steam production costs and the coming dearth of good river sites has prompted growing interest in thermal potential.

### 'On the Doorstep' of Coal Plants

"I believe we are on the doorstep of the large use of coal waste for steam electric production," predicted Earl Coe, Washington state conservation director. He told a recent Coal Research, Inc, conference that failure to exploit the state's 63-billion ton coal reserves has led to closure of virtually every mine in the state or operation for only a few hours a week.

Meanwhile, Pacific Power & Light Co and Washington Water Power Co are cooperating on a study of local coal deposits. The geological study, including core drilling, will be made near Centralia, Wash.'s Cascade foothills to determine whether the deposits could support steam plants. The companies say they'd need proved 40-50-yr reserves of low-cost coal before building a station.

# SEE Told Nuclear Costs Will Drop

## Atlanta four-session meeting of Southern utilities hears A-plant and fuel costs will fall 50 and 35% in 8 years

Cost of nuclear plants of the Dresden Station size will be reduced about 50% within the next eight years, and nuclear fuel costs will be cut 35%, the Southeastern Electric Exchange Engineering & Operation Section was told recently at Atlanta, Ga.

But these reductions won't come without continued electric industry support, said O. B. Falls Jr, General Electric Co. Power companies should not only investigate new types of reactors, but should agree to build several successive reactors of the same basic type. Thus the experience-improvement factor will be given a chance to contribute. Falls said that at this stage of completion of the Dresden Station the latest cost estimates are still in accordance with 1955 estimates.

### Data Processing Stressed

Important in the selection of data-processing equipment for engineering work are availability of library programs, automatic coding systems, and provisions for indexing and floating point calculations, said L. J. Rankine, International Business Machine Corp. He added that a program library should not obviate good programmers.

Also reducing programming effort are automatic coding systems permitting the programmer to think more in his own language, said Rankine. They permit maximum utilization of equipment by automatically assembling the program in the most efficient manner feasible for machine execution.

H. C. Leonard, Gulf States Utilities Co declared that engineers as well as other employees have the responsibility of working for and maintaining good public relations. At the local level, employees should continuously build good will through fair dealings, he said.

Low-cost, delayed coke at the Yorktown Power Station increases the heat rate by about 125 Btu per net kwhr over use of coal only, said John M. McGurn, Virginia Electric & Power Co. Delayed coke, having a low volatile content, is blended with coal in 50% proportions to provide a homogeneous mixture of medium-volatile, pulverized fuel.

In addition to the low-volatile content, undesirable characteristics of delayed coke are the wide range of ash fusion temperature, high sulphur content, and presence of vanadium. To counteract these shortcomings, several features were incorporated in the design of the unit:

**1.** Furnace was designed for 10% lower heat release than normally employed for coal.

**2.** Water-cooled spacers and hangers were employed in superheater and reheater sections and nickle and molybdenum were avoided to minimize vanadium-sodium attack.

**3.** For the same reason, corrosion-resistant material was used in the induced draft system.

**4.** Increased spacing of elements throughout the entire superheater eliminates excessive slagging and fouling of surfaces.

**5.** Slightly oversized pulverizer permit handling of coke containing a small amount of residual oil.

Turbine heat rates are determined by plant instruments and a digital computer, said W. M. Stephens and C. F. Whitmer, Georgia Power Co. The goal is to establish economic frequency of major overhauls and when to accelerate or defer scheduled maintenance.

Tests are made with plant instruments before and after turbines are overhauled. These data are put into a Type 650 computer which solves 79 equations to provide the desired answers. Although these results cannot be considered as an accurate indication of actual turbine performance because of the test instrumentation, a comparison of the before-and-after overhaul computations gives a reasonably accurate indication of performance change.

The computer calculates heat rate answers for six test runs at various valve points in about 12 min, they said, compared with 500 to 600 manhours to do the job with a desk calculator. Rental charge of a computer is $1.00 per minute, and non-recurring costs $2,000.

A new problem facing power companies is the change of oxygen concentration of water discharged through hydro plants, said Dr. D. W. Pritchard, Johns Hopkins University. This change in physical properties is viewed as detrimental by several agencies and, thus is definable as pollution, even though the company adds no waste to the stream.

### Held Contamination

The change concentration is caused by impounding water behind a dam. During summer this water stratifies due to temperature differential between top and bottom of the lake, and this differential prevents circulation. The water at the bottom is reduced in oxygen by aquatic life and decomposition of organic matter. Because this water does not mix with water at higher levels, the oxygen is not restored. And it is water with low oxygen concentration that is drawn into intakes for the generators and discharged in the tailrace.

### Likes Canned Motor Pump

Two years' experience with the canned motor pump for circulation service on a controlled circulation boiler has resulted in this conclusion by Virginia Electric & Power Co: "We believe that this is a good pump." During the 15,000 hr of operation, said J. R. Slack, some design changes were made and more are expected. The bearings should be improved, and the buildup of oxides in the upper pump cavity on the thermal barriers must be prevented. Because air is believed to have caused bearing failures, changes in venting are currently being studied.

Florida's first coal-burning power plant cost $112 per gross kw of capability, excluding cost of site and dredging, said A. D. Jones, Tampa Electric Co, and W. E. Hopkins, Stone & Webster Engi-

neering Corp. Heat rate of the unit, which has a cyclone furnace, is 9,755 Btu per kwhr at net output of 124 Mw.

In designing the stations, they said, cost and reliability were evaluated for each part of the plant, many parts being omitted, including by-passes at feed water heaters and deaerating heater. All auxiliary rotating equipment, except the boiler recirculating gas fans, are on the ground floor. Forced-draft system is straight horizontal run. The stack is placed on steel work to obviate added piling.

Many weaknesses of undervoltage protection for station auxiliaries may be overcome by using two relays per installation, said W. R. Brownlee, Southern Services, Inc. Each relay should be supplied from different phases, with contacts in series and supervisory lights to detect individual failures.

Some weaknesses of undervoltage protection that cause false operations are corrosion or deterioration of relay elements, weak spring clips on secondary fuses, blown fuses or defective potential transformers, and human errors involving testing and wiring. A valuable addition to station protective methods, Brownlee said, is a fast-acting highly dependable flame monitor.

#### Flattens Load Curve

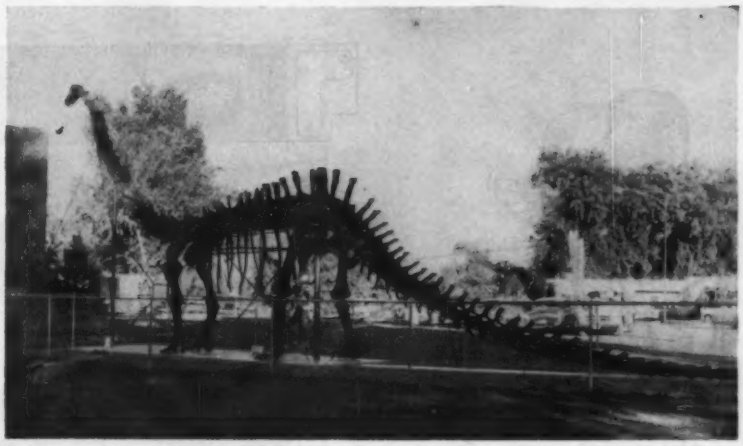
Use of pump-turbines offers a means of flattening out the load curve by storing hydraulic power during off-peak periods and generating from that power during peak periods, said F. B. Jaski, Allis-Chalmers Manufacturing Co. Pump-turbines can be applied in places unsuitable for conventional hydraulic turbines.

A new 75-mile, 230-kv line, comprising triple, double, and single-circuit steel structures, has been installed by Louisiana Power & Light Co, said Morris Steiner Jr. Single-circuit structures across a lake were not designed with broken-conductor strength.

When a conductor breaks, J-bolts at suspension clamps allow the conductor to slip.

Each single-circuit tangent structure is secured to a foundation having only two cylindrical hollow prestressed concrete pilings. Cemented

(*Continued on page* 144)



## Dinosaur Gets an Electrifying Tail

They've found a new use for electricity in Utah.

On the front lawn of the Utah Field House of Natural History in Vernal stands the 70-ft skeleton of a Diplodocus—a dinosaur that used to run around near Vernal several million years ago. It was put together, piece by piece, out of 700 bones by the director of the field house, Dr. G. E. Untermann.

The dinosaur has become popular with tourists, so popular in fact that many wanted to take home a rib as a souvenir. But just when it looked like Vernal's dinosaur was going to disappear completely, Dr. Untermann enlisted the aid of electricity.

Now a charge of current runs down the skeleton's tail, and woe to the tourist or teen-ager who ventures to lay a hand on the precious bones.

A prominent sign reads:

"WARNING!! High Voltage . . . Stay Outside Fence . . . This skeleton is charged with HIGH VOLTAGE Electricity!"

## '58 LBE Target: New Home Market

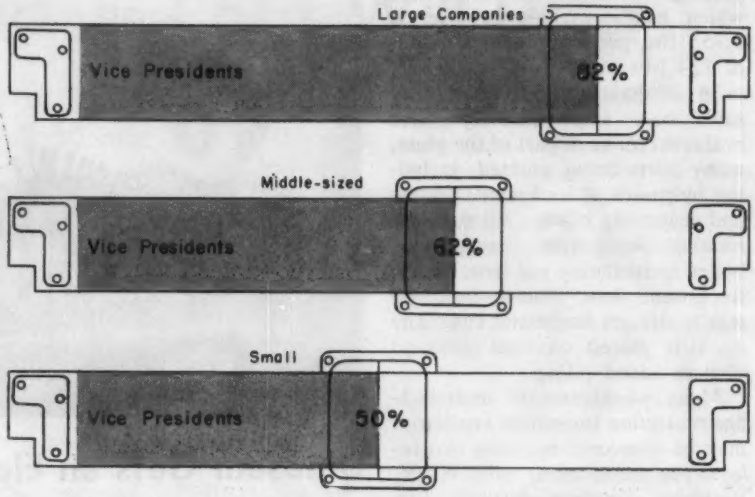
"Live Better . . . Electrically" announced its national campaign plans for 1958 last week in New York. Designed to capture a larger electrical slice of the new home market, the centerpiece of the '58 operations is the new "Home Medallion" program, in which the local utility will provide a bronze medallion to each new home built in its territory which meets certain electrical standards. The standards cover wiring, lighting and appliances.

Utilities will adjust their own standards within a national framework. The object of these standards are:

- To give new home buyers a symbol to indicate electrical excellence.
- To raise the electrical content of new homes.
- To sell more homes by stressing benefits of electrical living.
- To give support to present electrical market development programs.

Industry leaders hope HM will provide the needed crutch to boost lagging residential kwhr sales due to the drop in new home starts.

LBE plans to broaden and intensify its other promotions also, generally following EEI's promotional calendar. Emphasis will be on manufacturer support. High ranking executives of seven large companies outlined their companies' 1958 LBE-support programs in New York.




**An electric company's top engineer may hold the title of vice president, or may not . . .**

# Where Does the Engineer Stand?

**GEORGE W. PEAK,** Director of Organization Planning, Public Service Co of Indiana

That engineers perform a vital function in an electric utility company is obvious. How to organize them so they can best perform that function is not so obvious.

Electric companies don't all tackle this problem the same way. A study of the organization charts of 86 companies shows that some place their top engineers closer to the "top" than others do. All do not group their engineers the same way.

The facts presented here pertain to the organization for management of systems planning, design, and construction engineering activities. "Large" companies are those having over $100 million annual revenue. "Middle-sized" companies range from $25 million to $100 million. Companies under $25 million are classed as "small".

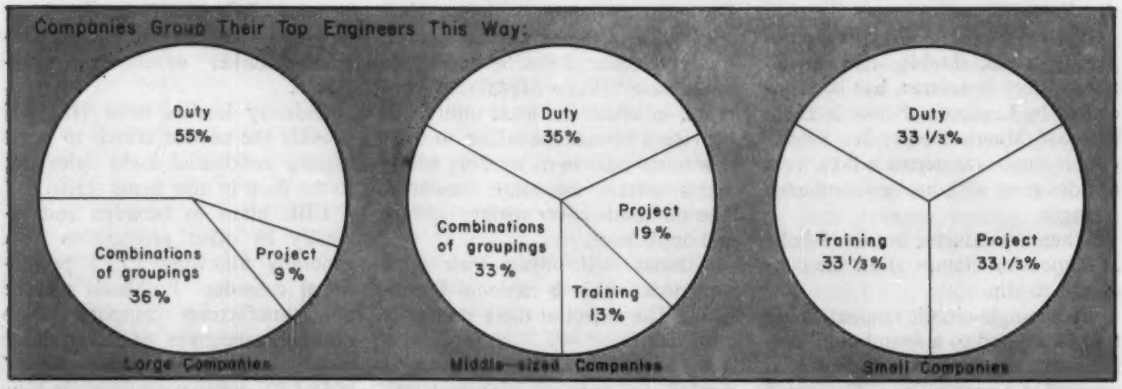
Even within these size groups, there is much diversity in organization for engineering management.

Almost 65% of the main engineering executives are vice presidents. The larger the company, the more likely it is that the top engineer will hold that title.

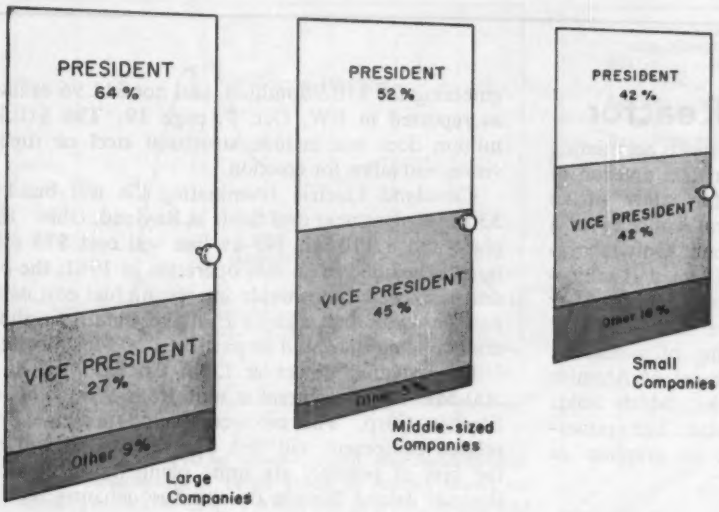
In well over half the companies that do not give the top engineer a vice presidency, the title in use is "Chief Engineer".

In many cases, though not a majority, the main engineering executive is also responsible for electric operations.

In most larger companies, and a decreasing percentage of the smaller ones, the top engineer is responsible directly to the president. A vice president is the next man above him in most other cases. In some of these, engineering vice presidents re-




**HOW ARE THEY GROUPED? Some electric companies group engineers by duty (design or construction), some by the type of project worked on, and some by the engineering specialty in which trained. Many use a combination of these**




**His boss may be the president, vp, or another executive . . .**

# 86 Utilities Surveyed

port to other vice presidents with broader managerial jurisdictions.

Only five companies have their top engineer report to an executive without company-officer status.

Most companies, 69% of the large ones, interpose no intermediate executives between top engineer and president. In 38% of all companies there is one intermediate executive. Only a few have more than one.

When it comes to grouping their senior engineers, electric companies favor three general breakdown methods:

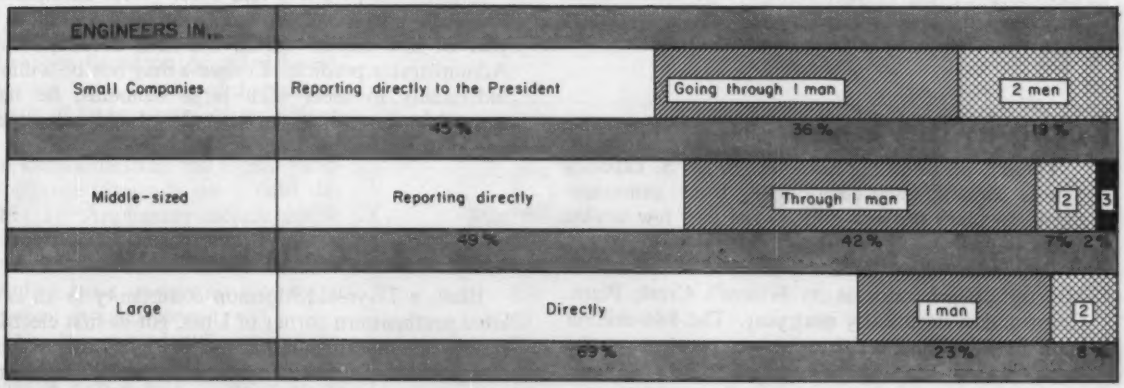
1. According to the engineers' duties in the company (e. g. design engineers are grouped together, and so are construction engineers).

2. According to the type of project they work on, such as transmission lines or substations.

3. According to the field of engineering in which they were trained; mechanical, civil, and electrical engineers being grouped separately.

Any one of a number of combinations may also be used.

Grouping by duty is most popular, although the larger companies also use many combined groupings. This brings out the point, noticeable throughout the study, that efficient organization for engineering management cannot be reduced to a formula, but must be designed to meet the needs of the individual company.




**WHOM DOES HE GO THROUGH? To see the chief executive the top-ranked engineer may go through several intermediaries. Discrepancy of figures between cartoon above and this chart is caused by dissimilar samples**

## SW Group Explores Reactor

Southwest Atomic Energy Associates is negotiating a contract with Atomics International, a division of North American Aviation, Inc, for study of an epithermal breeder reactor. The deal would cover a four-year, $5-million research program. Only laboratory research and development work aimed at achieving a critical experiment would be sought. After determining economic and technical feasibility, the utilities then would explore building of a reactor.

The reactor type is an improvement of Atomics International's sodium reactor series, which holds promise for high-temperature operation. The epithermal breeder might use beryllium or graphite as moderator.

## Panacea for Hot Heads

Safety Director Harold W. Masters got tired this summer of being put on the spot by Utility Line Construction Co employees who said, "Hard hats are too hot."

He rigged up a 250-w heat lamp over three wooden heads. Then he measured the temperatures of three types of hats by means of thermocouples. The findings:

| Hat Types | Outside Temp | Inside Temp |
|---|---|---|
| Cap | 112 deg | 110 deg |
| Felt hat | 112 deg | 108 deg |
| Hard hat | 110 deg | 88 deg |

## 600 Mi of Electric Railway

France has signed an agreement to assist the Indian Railways to electrify over 600 mi of railroad in the Calcutta area, McGraw-Hill's World News reports. The project entails use of a technique pioneered by the French Railways in which trains are run on single phase current at the ordinary industrial frequency of 25 kv and 50 cycles.

## Boom in Big Units

There'll be some big additions to U. S. capacity figures around 1960-61, judging from announcements on plans for new units in the past few weeks. Items:

Tennessee Valley Authority plans to install a 500-Mw turbine-generator at its Widow's Creek Plant. Construction starts early next year. The $86-million station will be financed from power revenues at the start. General Electric Co's bid of $16.11 million was low for the turbine-generator. Low bid for the steam generator was submitted by Combustion Engineering for $10.96 million, and not $11.96 million as reported in EW, Oct. 7, page 19. The $10.96 million does not include structural steel or supervision and labor for erection.

Cleveland Electric Illuminating Co will build a 335-Mw plant near coal fields at Rayland, Ohio. The plant and a 110-mi, 345-kv line will cost $75 million. Scheduled to go into operation in 1961, the big unit is expected to provide interesting fuel cost comparisons with the utility's Eastlake Plant. Eastlake coal is being delivered in part by a 108-mi pipeline.

Pennsylvania Power & Light Co has ordered a 300-Mw turbine-generator unit from Westinghouse Electric Corp. The cross-compound machine and related equipment will cost $12 million. It will be the first of possibly six units planned for PP&L's Brunner Island Station on the Susquehanna River, 15 mi below Harrisburg.

## The Road Ahead . . .

Pennsylvania Electric Assn this month embarks upon its second half-century of existence. To heighten the drama at its historic 50th annual meeting in early October, PEA adopted as its theme "Fifty Years of Progress—and the Road Ahead."

Retiring PEA Pres R. P. Liversidge said, "The electric light and power companies of Pennsylvania have come a long way over the short period of 50 years. Great physical plants have been built to improve our service to a point of being almost perfect. Now we have already started on the 'Road Ahead,' the road to final solutions of problems in the field of atomic energy."

The group later elected Joseph O. Chambers of West Penn Power Co to the PEA presidency to start the group on its next half-century of work.

## $1 Billion a Year

Electric cooperatives and other Rural Electrification Administration borrowers may need $1 billion a year of new capital within the next decade, REA Administrator predicts. Congress may not be willing indefinitely to meet such large demands, he has warned borrowers, urging that they build net worth and plan for a sound financial future.

## Utah P&L Calls on Bluff

Bluff, a 77-yr-old Mormon community in an isolated southeastern corner of Utah, got its first electric service last month. Utah Power & Light Co crewmen completed a distribution system for the 200 residents who happily junked "sad" irons and lanterns. The town is in the oil and uranium-rich four corners area.

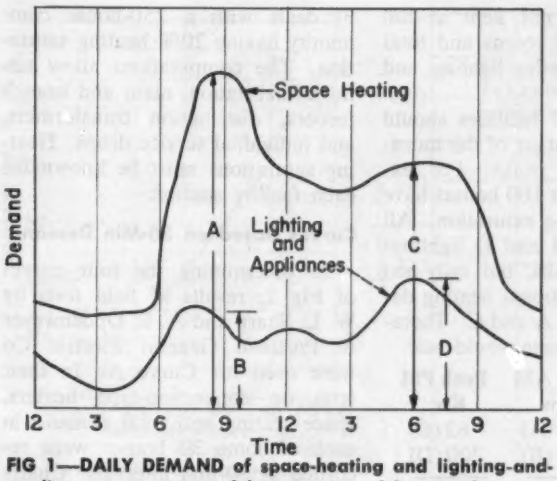



**FIG 1—DAILY DEMAND** of space-heating and lighting-and-appliance components of large group of houses shows coincidental peaks: One at 6-11 AM, other at 6 PM. Range and water-heater saturation is 100%; space heating, 0-100%

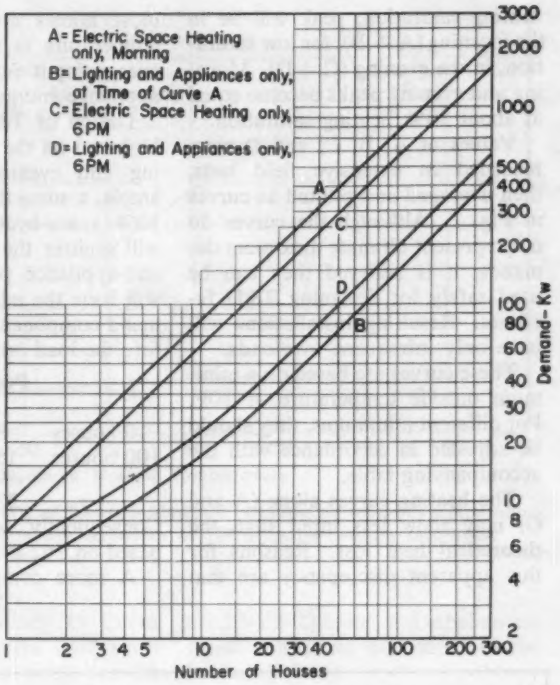



**FIG 2—MAXIMUM DEMAND** of a house group is either A + B or C + D at 10F minimum outside. The curves can be used safely for designing T&D facilities. Resulting installations will experience only infrequent but safe overloads

# Demand Curves Aid T&D Design

**DISTRIBUTION**
Design

## Curves assist in accurate design of facilities for serving new load patterns created by the growth of space heating

**R. E. SINCLAIR,** Rate Engineer, Pacific Power & Light Co, Portland, Ore.

With the help of the curves on these pages, transmission and distribution facilities can be designed more accurately for serving the new residential load patterns created by growth of electric house heating. The curves, representing composite electric living habits of many families, are based on recorded house-heating and lighting-and-appliance loads of large groups of residences.

Tests show the relationship of residential heating and lighting-and-appliance demands on a cold day (Fig 1). Appliances include 100% range and uncontrolled water heater saturation. The heating systems studied have units with thermostat control in each room.

For less than 100% space-heating saturation, heating demand will be correspondingly lower, while lighting-and-appliance demand for the same number of houses will not change appreciably.

Space-heating invariably attains a daily peak between 6 and 11 AM. This peak is caused by warm-up following nightly reduced thermostat settings. Lighting-and-appliance load, on the other hand, peaks at 6 PM.

For this analysis, space-heating demand is termed A at the morning peak and C at 6 PM. Lighting-and-appliance demand is B in the morning and D at 6 PM.

Field tests indicate that maximum demand of a house group will be either A + B or C + D. For high

**Factors for Adjusting Temperature**

| Minimum Outside Temperatures | Multiplying Factors (for use on Fig 2) Curves A and C | Curves B and D |
|---|---|---|
| 30F | 0.74 | 0.892 |
| 20 | 0.88 | 0.952 |
| 10 | 1.00 | 1.000 |
| 0 | 1.11 | 1.039 |
| −10 | 1.19 | 1.075 |

Adapted from a paper presented before Engineering & Operations Section of Northwest Electric Light & Power Association

heating saturation, peak will be in the morning (A + B); for low saturation, in the evening (C + D). Morning and evening peaks become equal at about 30% heating saturation.

Values of A, B, C, and D were recorded in extensive field tests, then averaged and plotted as curves in Fig. 2. Although the curves do not represent ultimate maximum demands, it is believed they can be used safely for designing T&D facilities. Resulting installations will have only infrequent overloads.

These curves are based on a minimum outside temperature of 10F. For different minimums, they should be adjusted in accordance with the accompanying table.

The heating curves alone (A and C) may show less input than the theoretical heat loss. Reasons for this apparent discrepancy are that most homes are not kept at full temperature in all rooms and total energy input includes lighting and appliance energy.

Design of T&D facilities should be based on the larger of the morning and evening peaks. For example, assume that 100 houses have 10% space-heating saturation. All will register the B and D lighting-and-appliance peaks, but only ten will have the additional heating demand components A and C. Therefore the load estimate would be:

| | Peak AM Kw | Peak PM Kw |
|---|---|---|
| 10 houses | 84 (A) | 62 (C) |
| 100 houses | 150 (B) | 200 (D) |
| | 234 | 262 |

Consequently, design should be based on 262 kw, the larger peak.

A more complete example (Fig 3) deals with a 250-house community having 20% heating saturation. The computations allow sizing of substation, main and branch feeders, distribution transformers, and individual service drops. Heating saturations must be known for each facility studied.

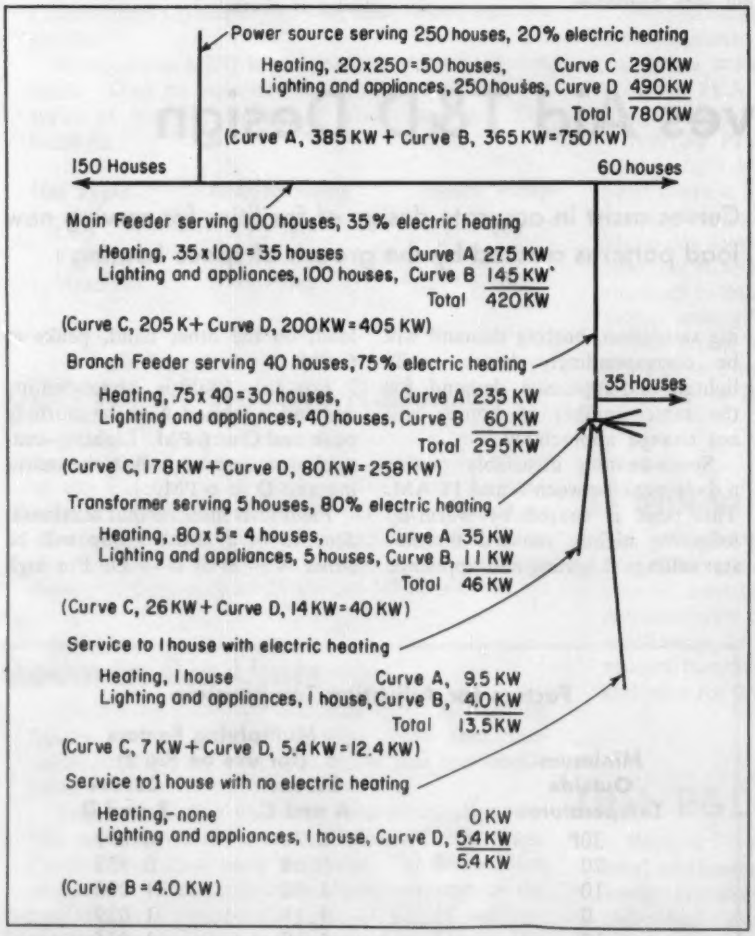

Power source serving 250 houses, 20% electric heating
Heating, .20x250=50 houses, Curve C 290KW
Lighting and appliances, 250 houses, Curve D 490KW
Total 780KW
(Curve A, 385 KW + Curve B, 365 KW=750 KW)
150 Houses
60 houses
Main Feeder serving 100 houses, 35% electric heating
Heating, .35x100=35 houses Curve A 275 KW
Lighting and appliances, 100 houses, Curve B 145 KW
Total 420KW
(Curve C, 205 K+ Curve D, 200KW=405 KW)
Branch Feeder serving 40 houses, 75% electric heating
35 Houses
Heating, .75x40=30 houses, Curve A 235 KW
Lighting and appliances, 40 houses, Curve B 60 KW
Total 295KW
(Curve C, 178KW+Curve D, 80 KW=258 KW)
Transformer serving 5 houses, 80% electric heating
Heating, .80x5=4 houses, Curve A 35 KW
Lighting and appliances, 5 houses, Curve B, 11 KW
Total 46 KW
(Curve C, 26KW+Curve D, 14 KW=40 KW)
Service to 1 house with electric heating
Heating, 1 house Curve A, 9.5 KW
Lighting and appliances, 1 house, Curve B, 4.0 KW
Total 13.5KW
(Curve C, 7 KW+Curve D, 5.4 KW=12.4 KW)
Service to 1 house with no electric heating
Heating,-none 0 KW
Lighting and appliances, 1 house, Curve D, 5.4 KW
5.4 KW
(Curve B=4.0 KW)

**FIG 3—SAMPLE CALCULATION shows how to size T&D facilities serving part of 250-house group. Larger of morning and evening total demand peaks is used**

### Curves Based on 30-Min Demand

In determining the four curves of Fig 2, results of field tests by W. L. Sharp and A. E. Opdenweyer of Portland General Electric Co were used for Curve A. In their tests on convection-type heaters, space-heating and total demand in each of some 30 houses were recorded at 30-min intervals. Charts were removed weekly, and the coldest week was selected for each of 14 months. This technique produced 98-day records of 30-min demand and related minimum morning temperature.

Detailed analysis by Pacific Power & Light Co engineers proceeded as follows: The period of coincident maximum 30-min heating demand (total of all houses) was noted for each day. For each of the 98 periods, maximum heating demands were totaled for groups of 1, 5, 10, 15, 20, and 25 houses selected by lot.

The 98 points were reduced to six by a weighted average method within temperature bands, and a semi-log graph, similar to Fig 4, was made for each house group. These points fell on a straight line which, when extrapolated, provided estimated demands for temperatures lower than those experienced in the test. From each of six plots similar to Fig 4, values for 10F were secured and plotted on Fig 2. Curve A was the result. Data for the table were then calculated from the other temperature points.

The upper extrapolation of Curve A was verified by Bonneville Power Administration's test on a feeder serving 230 houses, averaging 4,600 cu ft, with 100% saturation of space-heating, ranges, and water heaters. On a day with 22F minimum temperature, maximum feeder demand was 1,700 kw. Subtracting an estimated 320-kw coincident morning lighting-and-appliance demand gave a space-heating demand of 1,380 kw. As would be expected, this figure is somewhat lower than Curve A's estimate of

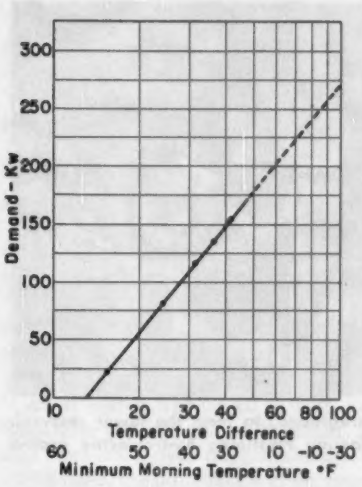



FIG 4—25-HOUSE GROUP, averaging 10,100 cu ft, has this type demand

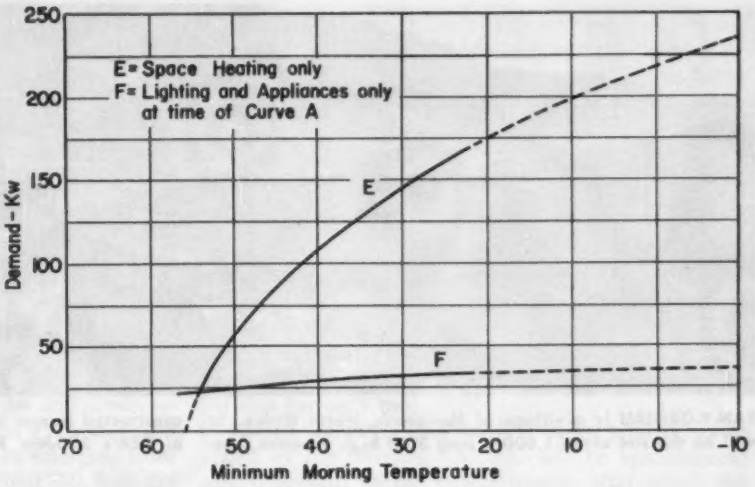



FIG 5—ARITHMETIC PLOT of 25-house demand vs minimum morning temperature gives further insight into characteristics of 100% space-heating saturation

1,640 kw for 230 10,100-cu ft houses at 10F.

Curve C of Fig 2 was established from Portland field data by determining the 25-house point only, using the same technique as for Curve A. Then Curve C was drawn through this point parallel to A. Were the curves not assumed parallel, they would intersect, indicating incorrectly that evening heating demand for a large number of houses would exceed morning demand.

Curve B, for morning lighting-and-appliance peak demand coincident with morning heating peak, was obtained also by use of Portland field data. Lighting-and-appliance demands were calculated simply by taking the difference in demand readings of heating and total load. This difference was taken each day at the maximum heating demand for the entire group of houses.

For each of the 98 test days, lighting-and-appliance demands were totaled for groups of 10, 15, 20, and 25 houses selected by lot. The resulting 98 demands were processed similarly to the Curve A demands. From the resulting four plots, values for 10F were plotted tentatively as a straight line on Fig. 2.

Curve D, evening lighting-and-appliance maximum demand, was determined from three separate field studies. A demand test on a BPA feeder serving 267 houses having 100% range and water-heater saturation, but no space heating, provided 111 observations. These were processed similarly to Curve A. Portland tests were used similarly to establish a point for 25 houses. A tentative straight line between the BPA and the Portland points paralleled tentative Curve B.

### Probability Applies for Few Cases

As the number of houses under consideration decreases below 25, more weight must be given to probabilities and less to averages. For example, Curve D shows 45.5 kw for 25 houses, an average of 1.98 kw. But O. O. Henderson, Kentucky Power Co, stated that extensive field tests show a 4.8-kw lighting-and-appliance demand for one house (EW, Oct. 29, 1956, p 72).

If this 4.8-kw demand is assumed to be at average temperatures, it can be estimated to be 5.4 kw at 10F (table). This point was placed on Fig 2 and connected by a curved line to the 25-house point, correcting tentative Curve D. Though determined independently, Curve D agrees closely with similar curves by Ebasco Services for 1 to 100 houses and by Utah Power & Light Co for 1 to 40 houses.

Curve B was then corrected to parallel final Curve D for the portion below 25 houses.

The linearity of Curves A and C below 25 houses is explained by the diversity resulting from the heating load, which is composed of individual heater groups in each house. In addition, space heating is always used with lighting and appliances, which contribute heat input to the house.

Although not verified by field test, Curves A and C could be expected to parallel B and D beyond 300 houses. Otherwise, the two groups of curves would cross, indicating incorrectly that lighting-and-appliance load would exceed heating load for some large number of houses.

Further insight into load characteristics is given by an arithmetic plot of 25-house demand vs minimum morning temperature (Fig 5). Space-heating Curve E increases with decreasing outside temperature but is concave downward, indicating a decreasing rate of increase. Curve E's equation is: Demand kw $= 300 \log (70 - T) - 334$ where T is minimum morning temperature, F.

Curve F, lighting and appliances, also increases with decreasing outside temperature. This characteristic can be attributed to cold water supply to water heaters and to larger lighting use in winter.

Users of Fig 2 are reminded that the curves represent demands registered by warm houses having diversity similar to water-heater diversities, because of individual room thermostats. Prolonged power interruptions will permit houses and water heaters to cool. Power restoration will then call for heat from all thermostats, producing much higher demands than normal.

**TAN-Y-GRISIAU is a village of Merioneth, North Wales. It will be the site of an 1,800-ft long 30-ft high concrete dam constructed (center foreground) to form the lower reservoir of CEA's 300-Mw Blaenau Ffestiniog hydroelectric project**

# Pumped-Storage Project Proves Out

Capital cost advantage of 2:1 over equivalent coal-fired thermal plant is predicted by Central Electricity Authority for its first pumped-storage hydro project under construction at Blaenau Ffestiniog, North Wales. In addition to savings in operating costs, it is expected that the 300-Mw project will aid nuclear power economy based on continuous operation by providing instantaneous peaking power during hours of peak demand. The project will feed power into Britain's 275-kv supergrid.

Economic justification of the project, as an alternative to a new thermal station of equivalent generating capacity, depended on the extent of savings due to:

**1.** Reduced annual capital charges because of lower capital cost and longer life of pumped-storage as compared with thermal plant.

**2.** Cost differential between off-peak pumping energy and peak-load energy supplied by thermal plant.

**3.** Lower operating and maintenance costs.

**4.** Ability of pumped-storage to serve as emergency standby capacity, with consequent savings in banking losses of thermal plant.

### Initial Savings $600,000 Annually

Against these factors were set the savings due to improvement in overall system thermal efficiency, which would accrue from construction of an alternative base-load thermal station. On balance, these factors even at present show a substantial financial advantage in favor of pumped-storage. Cost figures of 1955 (when this scheme was conceived) showed a capital cost for the Ffestiniog project of $35.4 million as against $65.5 million for an equivalent coal-fired station, excluding transmission costs in both cases. Tentative estimates of annual savings give $600,000 for the first year of operation (1962), rising to about $2.8 million in later years. When cheaper-than-coal-fired night-time pumping energy is available from nuclear plant, the savings will be increased further.

The Ffestiniog project will have a total generating capacity of 300 Mw. It has been designed for normal operation during the winter months when the plant will generate for about 4½ hr daily five days per week. Pumping will be spread over about 6½ hr during each of the five nights. Allowing for additional operation as emergency standby capacity, it is estimated the annual output will amount to some 300 million kwhr, or an annual 11.4% load factor.

Main civil engineering features of the project are shown in the accompanying illustration. The upper reservoir will be formed by enlarging an existing lake (Llyn Stwlan) situated at about 1,600 ft above the datum line. A concrete buttress dam 1,200-ft long and

### Vital Statistics of the Blaenau Ffestiniog Pumped-Storage Project

| | |
|---|---|
| Location | North Wales |
| Cost | $34.5 million |
| Estimated annual savings* | |
| First year (1962) | $600,000 |
| Subsequent years | $2.8 million |
| Installed capacity | 300 Mw |
| Estimated annual output | 300 million kwhr |
| Annual load factor | 11.4% |
| Mean static head | 1,000 ft |
| Active storage | 1,500 acre-ft |
| Generator-motor | |
| Speed | 428 rpm |
| Gen. rating | 75 kw, 95% pf, 16 kv |
| Motor rating | 75 kw, 100% pf, 16 kv |
| Turbine | |
| Type | Francis |
| Power developed | 105,000 bhp at 970-ft head |
| Pump | |
| Type | Two-stage, double-inlet |
| Capacity | 745 sec-ft at 1,000-ft head |
| Power required | 94,000 bhp |

* As an alternative to a new base-load thermal plant of equivalent capacity

90-ft high will be built, providing working storage capacity of roughly 1,500 acre-ft with a 74-ft drawdown. The lower reservoir will be formed in the Afon Ystradau valley by a concrete buttress dam 1,800-ft long and 30-ft high. The lower reservoir will have an 18.5-ft variation in water level. Difference in elevation between the two reservoirs will provide a mean static head of just over 1,000 ft.

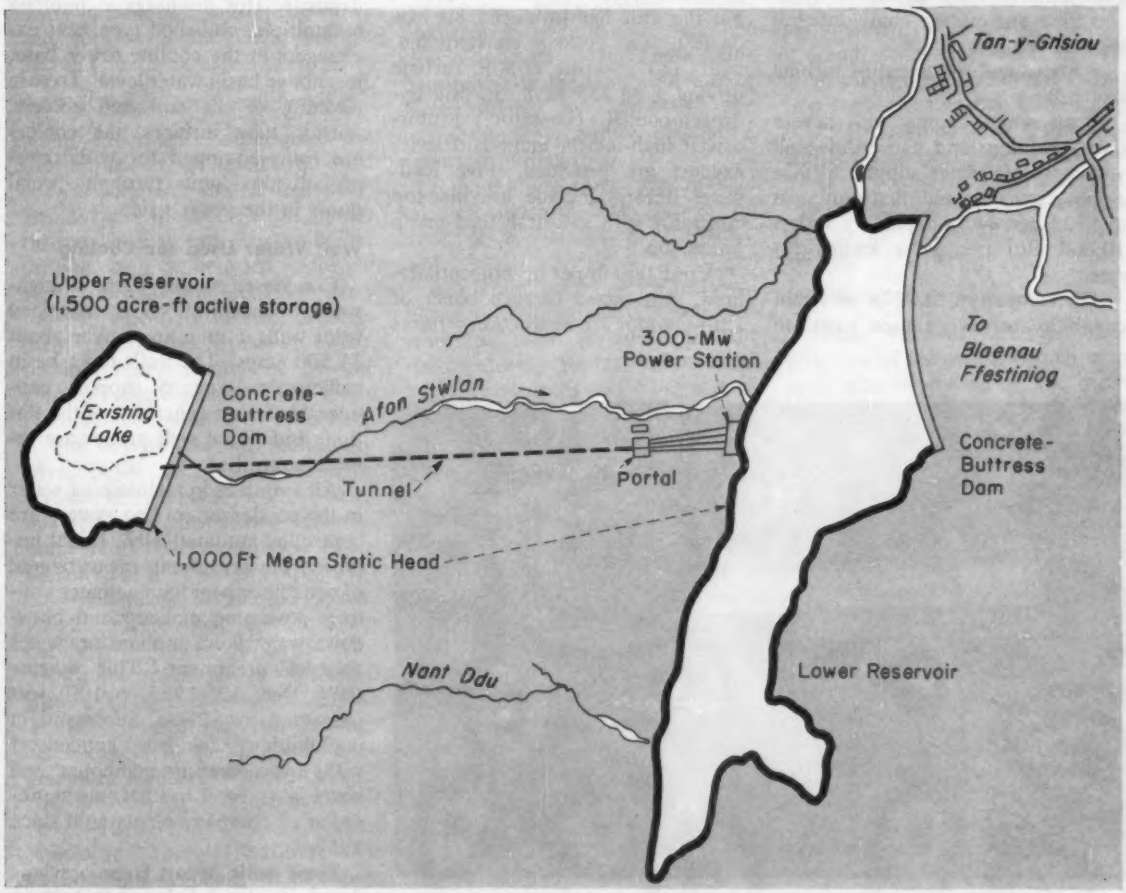
From the upper reservoir water will be drawn through two intakes adjacent to the dam. These will lead into two 14.5-ft diam vertical shafts extending 760 ft below top-water level. From the lower end of each shaft two parallel tunnels of circular cross-section will be driven 4,000 ft at a slight downward gradient to the side of the hill.

Each tunnel will be 10 ft 8 in. in dia and concrete-lined over the first half of its length, and 9 ft 5 in. in dia and steel-lined over the remainder. On emerging from the hillside, the aqueduct will become four 7-ft 8-in. dia steel pipe-lines extending 700 ft down the hillside.

The 270-ft long, 70-ft wide power station building will be constructed above ground on the western side of the lower reservoir. The plant will comprise four units, each consisting of a pump, turbine, and generator-motor coupled together on a vertical shaft. Generator-motors at the upper ends of the shafts will be coupled rigidly to Francis-type turbines, which will discharge through short draft tubes into the lower reservoir. The two-stage double-inlet pumps will be below and connected to the turbines by disengageable couplings. Pumps will draw water from intakes adjacent to the turbine discharges and deliver it to the four pipelines, each serving for generation and pumping.

During generation the pumps will be uncoupled from the turbines, but during pumping the turbines will, of necessity, rotate. Therefore, provisions will be made for dewatering the turbines at such times by admission of compressed air to the spiral casings. Pump couplings of simple toothed design will operate by oil pressure when machines are stationary. Changeover from full-load pumping to full-load generation will require about 10 min for each unit.

Pumps will be started by first being brought up to speed by the turbines. Motors will be synchronized and connected to the power source, after which the turbines will be shut down. Pumps will then be loaded gradually by opening the discharge valves. This procedure will require that, at initial startup, satisfactory running of the turbine is proved before pumps are brought into operation. Initial filling of the upper reservoir will be provided by an auxiliary pump drawing from the lower reservoir, fed by two streams.




**BLAENAU FFESTINIOG PROJECT will create an upper reservoir at an existing lake (Llyn Stwlan). Vertical 760-ft shafts and a 4,000-ft tunnel will feed steel pipelines at the portal to conduct the water to CEA's new 300-Mw power station**

# New Plant Uses Design Confirmed by

## Yet new features are included in 80-Mw unit at Southwestern Public Services' Cunningham Station

**E. W. ROBINSON**, Chief Engineer, Generating Station Design, Southwestern Public Service Co, Amarillo, Texas

Southwestern Public Service Co's 80-Mw Unit No. 1 at new Cunningham Station has "gone commercial," doubling generation economically available to the company's burgeoning southeastern New Mexico service area.

Cunningham is believed to be an accurate extension of design tenets confirmed by experience with ten previous steam stations.

But new features have been added including:

- Leather-finished and ceramic-coated aluminum exterior.
- Pipe and wiring chase integral with elevator shaft.
- Acoustical treatment of turbine bay ceiling.

Even while coping with severe dust conditions and high-solids well water as sole water supply, SPSCo engineers have held first-unit cost to $122 per kw of capability with a 10,600 Btu per gross kwhr heat rate.

The company's 815 Mw of steam capability serves an area equal to Pennsylvania plus Rhode Island. Interconnections to substantial neighbors don't exist. The system, serving mainly the Texas Panhandle, extends into Oklahoma, Kansas, and New Mexico, requiring 3,500 miles of 69, 115 and 230-kv transmission. Cunningham's location adjacent to the New Mexico service area will remove that area's partial dependence on a single 110-mile 115-kv connection to the main system. Simultaneously, transmission penalty on generation to the area will be reduced.

### Five Feedwater Heaters Used

Cunningham No. 1's turbine and generator bear 70-Mw nameplates, but the unit has produced 80 Mw on test. The cycle is conventional, with a 1,250-psig, 950F turbine driving a 88.235 Mva, 30-psig hydrogen-cooled generator. Motor-driven high-inertia main and spare exciters are provided. Five feedwater heaters include a boiler-top deaerator with anti-flash feed pump protection.

A 665,000 lb per hr, tangentially-fired, pressurized furnace boiler of semi-outdoor construction burns natural gas obtained locally. No oil or other standby fuel is used, as gas supply is considered firm. All vulnerable boiler parts are housed by aluminum wall panels attached to the boiler structural frame.

The condenser cooling system includes a 12-cell, 60,000-gpm, 8-F approach, induced draft cooling tower 360 ft long. Because cooling tower lumber treatment efficiency has not been fully determined by SPSCo engineers, this tower serves as a test structure. Half the tower was constructed of Erdalith-treated redwood and the other half of untreated redwood. As both halves are subjected to the same conditions, it is believed the test will be conclusive.

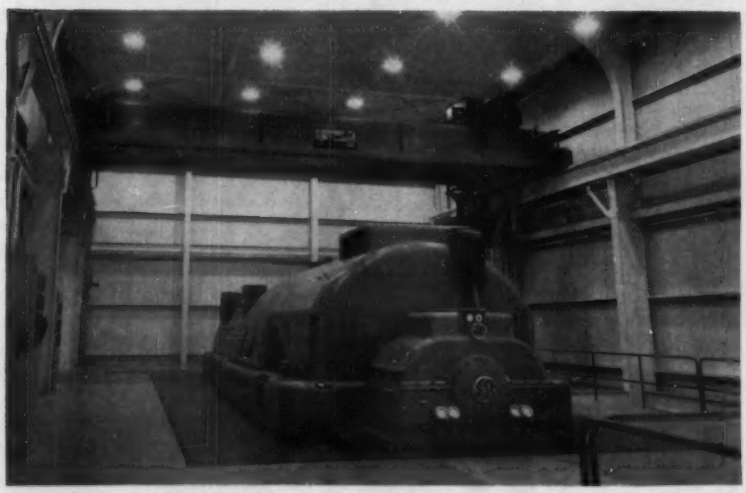
Specially treated water is used in a closed auxiliary cooling water system to prevent scale and sludge deposits. Hot discharge is pumped to multiple, coil-shed type heat exchangers in the cooling tower base, just above basin water level. To ease cleaning of the coil-shed coolers' outside tube surfaces, the coolers are roller-equipped for withdrawal of individual units through special doors in the tower's side.

### Well Water Used for Cooling

Condenser cooling water of high-solids concentration is obtained from wells 1 mile apart over about 11,500 acres. The wells tap a basin sufficiently large to support considerable future expansion of the station. Individual well pumps are remote controlled.

All variables in maintaining water in the condenser cooling system are controlled automatically. Initial impulse from continuous measurement of condenser heat load actuates controls governing makeup and blowdown water flows and makeup water chemical treatment. This scheme (EW, Dec. 12, 1955, p 100) was pioneered by SPSCo. Successful in maintaining scale-free condensers with low operating manhours and water wastage, it has become standard at all company plants built since 1952.

Plant walls depart from previous designs for insulated steel Robertson Q panels, in the use of aluminum for



**FIBERGLAS and perforated metal ceiling reduces turbine room noise about 20%. The ceiling was installed at 30% more per sq ft than conventional steel panel**

exterior surfaces but retain steel for inside surfaces. Because polished aluminum tends to accentuate imperfections, such as dents, scratches and stains, a "leather" finish was specified for building walls. Use of aluminum will eliminate exterior painting and is expected to "pay for itself" in about five years. To decrease cost of paint maintenance further, all building trim, including parapet caps and front entrance facade, was fabricated of ceramic-coated aluminum.

The elevator shaft, tallest portion of the structure, supports the microwave antenna. About 30 ft were added to the shaft to obtain the minimum elevation of 170 ft required for such equipment, and the extra room gained serves to house it.

A central vacuum cleaning system with suction outlets located conveniently in buildings and on the boiler will cope with the dust problem peculiar to the area.

**ELEVATOR SHAFT** was raised 30 ft to attain proper height for microwave antenna. Extra room at top of shaft houses transmitter and receiver equipment

### Control Room Air Conditioned

All station and line controls are centralized in an air-conditioned control room on the turbine floor. Bench-type consoles with miniaturized instruments serve boiler, turbine, and switchyard. Upright panels behind the consoles carry full-size recorders. Room arrangement permits operation of boiler, turbine, and switchboard by one control room operator. The entire plant will be operated by three men.

The 70-Mw generator feeds a 90-Mva, FOA, 13.2-115-kv, 3-phase transformer supplying a 115-kv ring bus having at present two line positions. Start-up station power is obtained from a 7,500-kva, OA, 115-2.4-kv 3-phase transformer energized from the ring bus's "vacant corner."

Normal station power is obtained from a 7,500-kva, OA, 13.2-2.4-kv 3-phase transformer tied through air breakers to the isolated phase generator leads. The present single-ring 115-kv bus will be expanded to a double ring with the second generator. Three 1,000-kva, OA, 2,400-440-v 3 phase transformers supply smaller 440-v auxiliaries.

At Cunningham, two full-capacity, 3,600-rpm, barrel-type feed pumps are motor-driven through fluid couplings, following another SPSCo standard design. These couplings have effected significant station power savings by eliminating the conventional feedwater regulating valve's throttling loss.

A 55,000-gal raw water tank is on the boiler roof deck, thus saving most of a conventional hi-tank's cost.

A 5,500 lb per hr, 450 psig once-through, fully automatic steam generator is used as auxiliary heat source during winter boiler overhauls. It occupies only 40 sq ft floor space. During initial startup, this unit supplied heat to the hot-line zeolite water softener producing the main boiler's initial fill, and to the turbine lube oil for hot-oil flushing.

Small-diameter water wells are used for station grounding. Ten 75-ft-deep holes, well below water table, contain 2-in. brass pipe electrodes which are tied into the plant ground grid.

Electric cable trays do double duty by carrying also much of the pneumatic instrument tubing. Armor-clad multitube "cable" was used to reduce instrument piping cost.

Heat tracing of water and instrument lines is minimized by use of an enclosed pipe chase integral with the elevator shaft and extending from basement to boiler top enclosure. Warm basement air in the pipe chase maintains an above-freezing ambient.

Small steam detrainers, installed in all piping systems subject to erosion from flashing hot water, serve as vessels in which flashing can occur without damage to piping systems. They're placed in hot drain lines between closed feedwater heaters and in the evaporator coil drains system.

### TV Part of Control Scheme

Boiler light-off will be under direction of the control room operator, who by means of TV, safety interlock control switches, remote valve position indicators, and a two-way intercom will direct operations of an assistant stationed on the burner platform during light-off.

High noise levels have been reduced about 20% by acoustical treatment of the turbine bay ceiling with perforated metal and fiberglas. Having a 75% noise reduction factor, the ceiling was installed at 30% more per sq ft than conventional steel panel.

Southwestern Public Service Co expects Cunningham to cost about $122 per kw on a 75-Mw capability basis, not including the substation, but including land, water rights, water collecting system, engineering and supervision, overheads and interest.

# Substation Lightning Protection

## Adequacy, economy hinge on arrester location, line insulation level, and shielding

T. J. BLISS, Electric Utility Engineer, Westinghouse Electric Corp, East Pittsburgh, Pa.

Adequate and economic protection of substation high-voltage equipment against lightning is obtained by establishing the proper relation between equipment insulation levels and lightning arrester characteristics. Protection is affected by arrester location, line insulation level, and line and station shielding.

Lightning surges enter a substation through a stroke either directly in the substation or on a line radiating from the substation. To cope with the lesser likelihood of direct strokes in the substation, it is recommended that substation shielding be obtained through aerial horizontal ground wires above the substation and/or vertical masts. In either arrangement, shielding devices must be well connected to a low-resistance substation ground mat. This prevents the stroke currents from raising the potential of steel-work, such as supporting structures or transformer tanks and cores, to the point where insulation will break down.

It is recommended also that lines radiating from the substation be shielded by ground wires for the first several spans from the station. Footing resistances of the line structures should be as low as practicable. Because of the greater physical exposure of circuits radiating from a substation, chances are greater that most lightning-caused surges in the substation will result from strokes on the outgoing circuits

Crest values and shapes of traveling waves entering the substation as a result of strokes to transmission lines are influenced greatly by line insulation level. For example, a stroke contacting a tower may raise the tower-top potential so that an insulator string flashes over to the phase conductor. This starts a steep-fronted, long tailed wave toward the substation on the phase conductor.

But insulator strings at each successive tower flash over until the surge magnitude is less than the line insulation level. Such successive insulator-string flashovers serve to create a short-tailed wave. Similarly, a direct stroke on the phase conductor out on the line cannot deliver to the substation a surge greater than line insulation level.

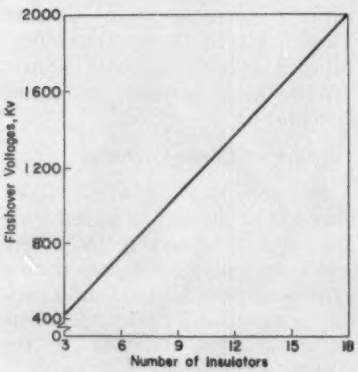



**FIG 1—FLASHOVER VOLTAGE (3 $\mu$-sec) is function of number of standard insulators in the string**

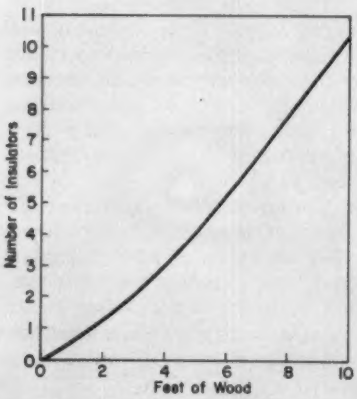



**FIG 2—VALUE of wood as insulation may be expressed in terms of equivalent numbers of insulators**

### Surge Strength Depends on Wave Shape

Magnitude of surge voltage which the line insulation passes depends on the wave shape of the surge. To allow for this conservatively, the 3-$\mu$-sec flashover value of the line insulators (plus a value representing the added benefit of wood tower arms, when used) is suggested as a practical crest value to assign incoming surges. This value is plotted in Fig 1 as a function of the number of standard 10 x 5¾-in. insulators. Estimates of the equivalent number of insulators represented by wood construction are given in Fig 2.

Upon entering the substation, a traveling wave of a certain magnitude may give rise to greater magnitudes of voltage impressed upon equipment. Theoretically, for the simple substation illustrated in Fig 3(a), the surge voltage at the transformer is twice that of the entering surge. Thus, the transformer may be subjected to surge crest values of twice the line insulation level.

For an over-simplified substation with two circuits, shown in Fig 3(b), a surge entering on one circuit does not produce a doubling effect because no reflection point exists. Similarly, with $n$ lines radiating from a common point, and a surge of crest $e$ entering on one of them, maximum voltage at the junction point is $\frac{2e}{n}$.

Thus, when five 230-kv steel tower lines with 16 standard insulators (3-$\mu$-sec flashover of 1,790 kv) radiate from a common bus, maximum surge voltage expected on that bus as a result of an incoming wave is $\frac{2 \times 1790}{5} = 716$ kv. This value is well below the insulation level of any equipment used in 230-kv substations.

It might be concluded that no lightning arrester is required insofar as incoming surges are concerned. It must not be overlooked, however, that it is just during a thunderstrom when circuits may be out. Consider

# Has 4 Determinants

in the above example that one line is out for maintenance. A second just trips out due to lightning when a stroke engages one of the three remaining lines, sending a traveling wave toward the substation. The resulting surge at the bus now will crest at

$$\frac{2 \times 1790}{3} = 1190 \text{ kv.}$$

This value is substantially higher than 1,050 kv, the highest transformer BIL recognized for 230-kv equipment. This example serves to warn against over-reliance on the presence of other circuits for limiting surge voltages.

Once the need for lightning arresters is determined, the problem of how many and where to put them must be solved. First, it must be emphasized that the best surge protection for transformers is obtained by placing the lightning arrester as near the transformer as practicable. But with the low-discharge-voltage characteristics of modern arresters, some separation is permissible. Often a separation distance is economically desirable, as it may allow one arrester to protect more than one transformer bank.

Due to the effects of voltage reflections in the more complex substations, separation distance cannot be generalized except for the simple case illustrated in Fig 3(c). With station-type arresters having the characteristics in the accompanying table, separation distances obtainable from Fig 4 are permissible. Curves in Fig 4 are based on these assumptions:

**1.** Rate of rise of the incoming surge does not exceed 500 kv per $\mu$sec.

**2.** Lightning arrester discharge current is limited by the magnitude of the incoming surge and the line surge impedance.

**3.** Lead length between the lighting arrester and the bus tap-off point does not exceed 35 ft.

**4.** Lightning arrester is grounded to the station ground mat.

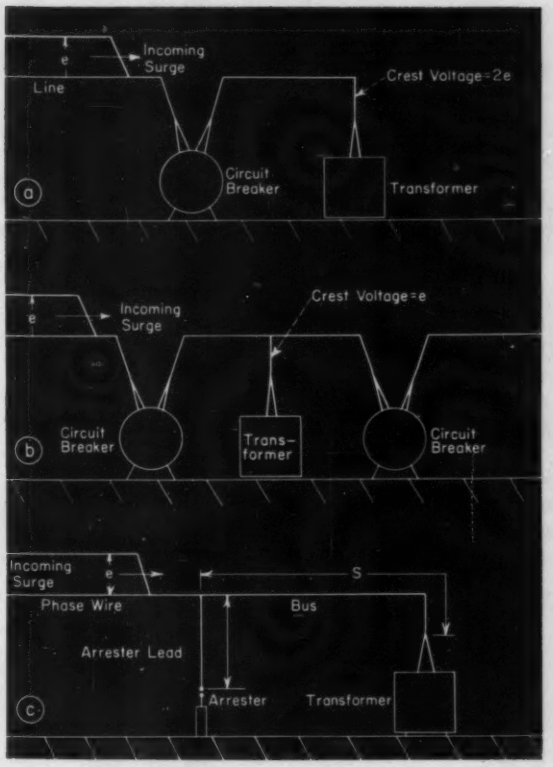



**FIG 3—LIGHTNING SURGE will produce a crest value of twice the surge level for arrangement (a). Surge will not double in (b) because of lack of reflection point. In (c) arrester within distance S of transformers will limit the surge**

**5.** Lightning arresters have the characteristics in the table on p 92.

To illustrate the use of Fig 4, consider a 161-kv substation having a transformer with 650-kv BIL insulation, a 145-kv lightning arrester, and a single line. The line is of wood construction with ten insulators

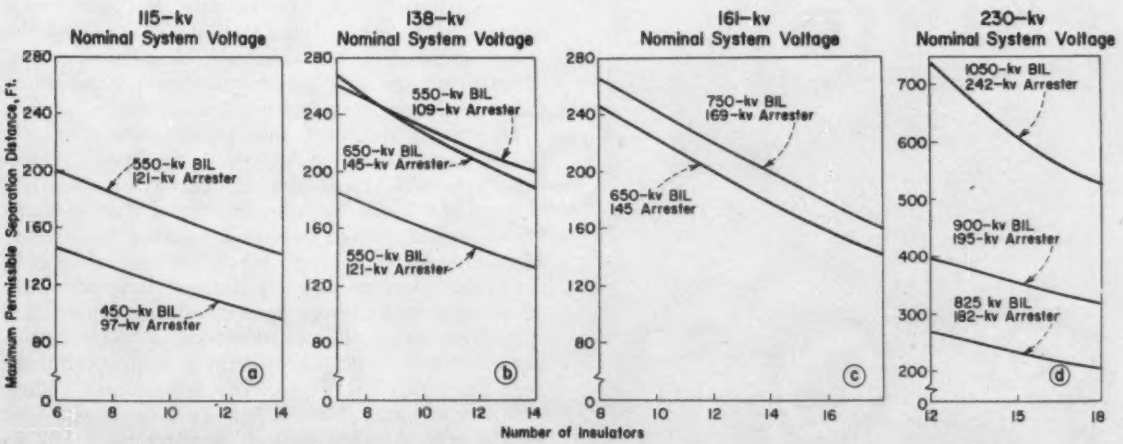



**FIG 4—MAXIMUM PERMISSIBLE DISTANCE between the lightning arrester and protected transformer is function of number of line insulators. For wood construction, add the equivalent insulators to represent wood path contribution**

and 7 ft of wood between the insulator string and the nearest grounded hardware. This length of wood path is equivalent to 6.5 insulators (from Fig 2). Adding this increment to the number of line insulators gives 16.5. From the 650-BIL curve in Fig 4(c), the permissible separation distance is 153 ft.

Separation distances in Fig 4 do not apply to transformers having two-step reduced insulation classes. For such transformers, it is recommended that separation distance be kept to a minimum.

### Computers Preferred for Large Stations

For a more complicated substation, manual calculations by the classical methods become impractical, as do generalized studies. An improvement over the classical calculation method is the analog computer on which various substation elements can be represented in electrical analog. Actual voltage waves are impressed on the analog circuit, and a cathode-ray oscilloscope determines the resulting voltage magnitude and wave shape at any point in the analog representing the power system.

This procedure greatly facilitates the solution when complicated bus structures with multiple lines, stub protections, and bushing capacitances are studied. It permits full study of the surge protection problem before the substation is built.

A more recent technique involves the synchronograph, which is essentially a portable, repetitive-pulse generator with one or more receivers. It can determine the surge response of actual field installations and does not require reduction to an analog circuit. But it has the disadvantage of not being applicable to substations in the planning stages, and a station must be taken out of service to permit use of the technique.

**Maximum Characteristics of Lightning Arresters**

| Arrester Rating Kv(RMS) | Impulse Sparkover Kv(Crest) | Discharge Voltage KV (Crest) for 10x20 Microsec 5,000 Amp* | 10,000 Amp | 100,000 Amp |
|---|---|---|---|---|
| 97 | 310 | 258 | 280 | 380 |
| 109 | 360 | 282 | 306 | 420 |
| 121 | 390 | 320 | 350 | 470 |
| 133 | 430 | 350 | 380 | 525 |
| 145 | 460 | 375 | 408 | 560 |
| 169 | 540 | 450 | 490 | 660 |
| 182 | 585 | 470 | 510 | 700 |
| 195 | 610 | 500 | 545 | 750 |
| 242 | 770 | 640 | 695 | 940 |
| 258 | 830 | 685 | 745 | 1,010 |
| 264 | 860 | 700 | 765 | 1,030 |
| 276 | 900 | 730 | 795 | 1,070 |

*Discharge current (crest)

Nevertheless, a valuable contribution of the synchronograph technique has been the confirmation of the analog computer method. For several specific installations analyzed by both methods, exceptionally close agreement has been obtained, as shown in Fig 5. Excellent checks between synchronograph results and full-voltage tests made with a 2,000-kv lightning surge generator also have been reported (AIEE Transactions).

### Synchronograph Verifies Protection Design

When a substation similar to an existing one is contemplated, analysis of surge protection for the new station through a synchronograph study of the existing one is perhaps the simplest method. Minimum number of lightning arresters and their optimum placement may be determined rather readily.

Short of conducting such studies or making detailed reflection calculations, separation distances in Fig 4 may be applied cautiously to substations having more than one line. For example, when two lines terminate on a bus at which an arrester is installed, the permissible separation distances between bus and transformer can be greater than that in Fig 4. Often this rough approach justifies the use of a single set of arresters on the bus, protecting several transformers fed from the bus of a multiple-line station.

In general, the most appropriate arrester has the lowest rating permitted by system conditions. Under conditions such as loss of load, runaway of hydro machines, and faults, considerably more than nominal line-to-ground voltage may appear across the arrester. Maximum value of such 60-cps voltage should be determined because arresters are not designed to cut off power-follow current against voltages higher than nameplate rating. For example, on a given 230-kv circuit under single line-to-ground fault conditions, the voltage may be 173 kv. This is below the voltage rating of an arrester rated 182 kv. On circuits with such a well grounded neutral, arresters rated 182 kv or 75% of maximum circuit voltage have been successful.

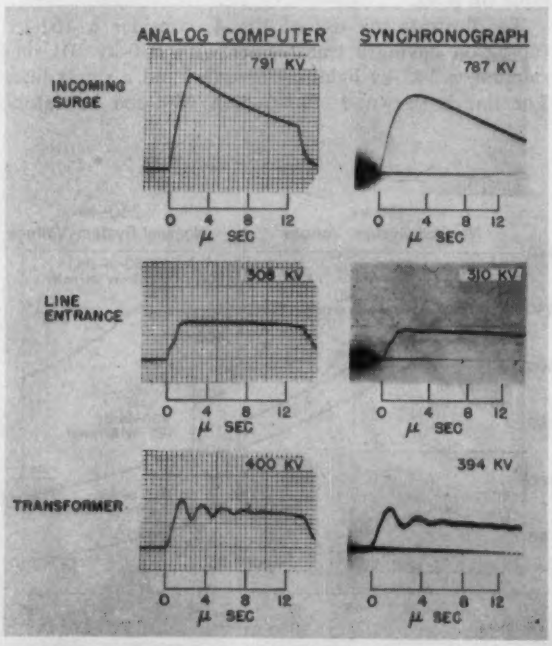
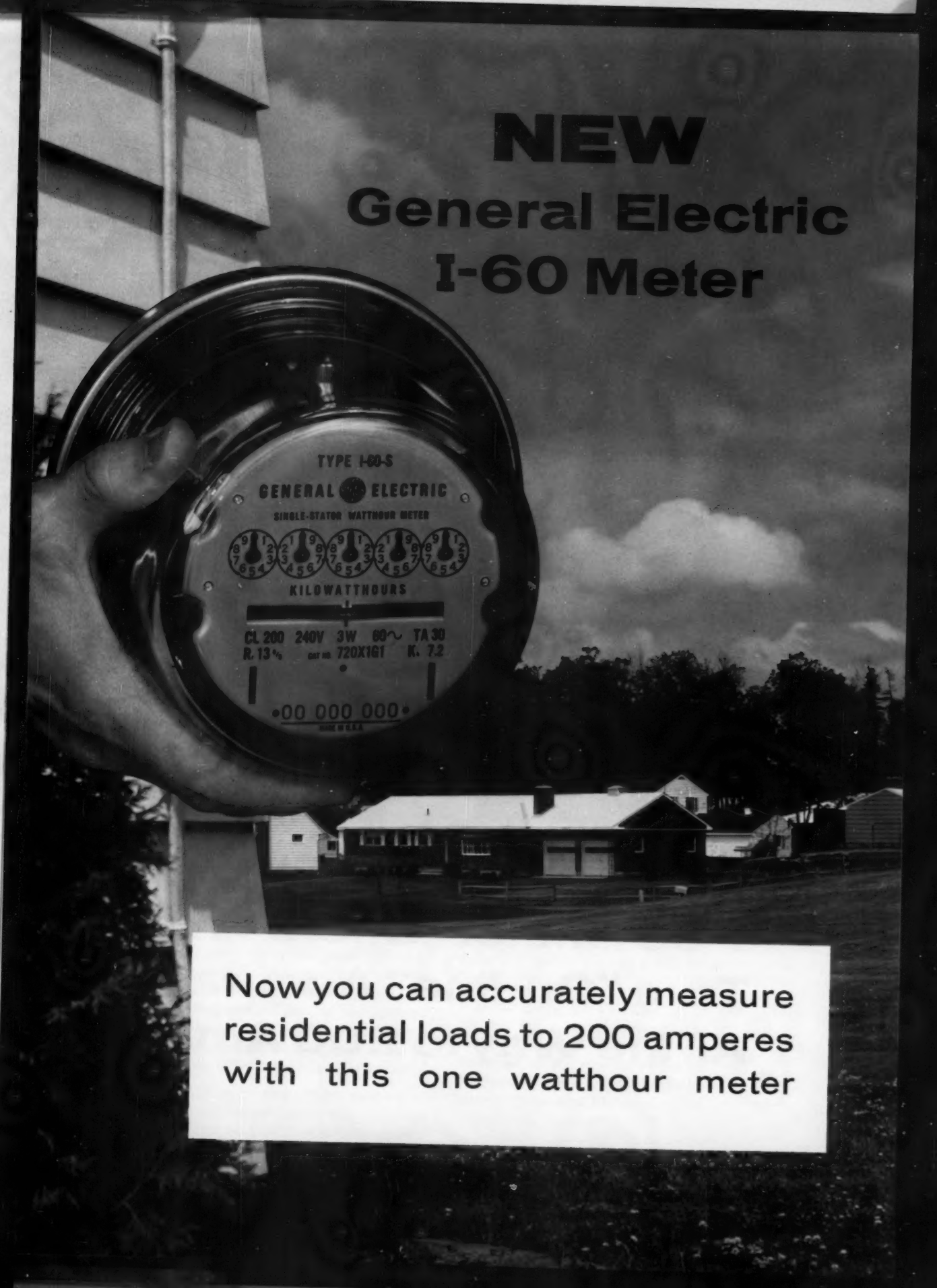
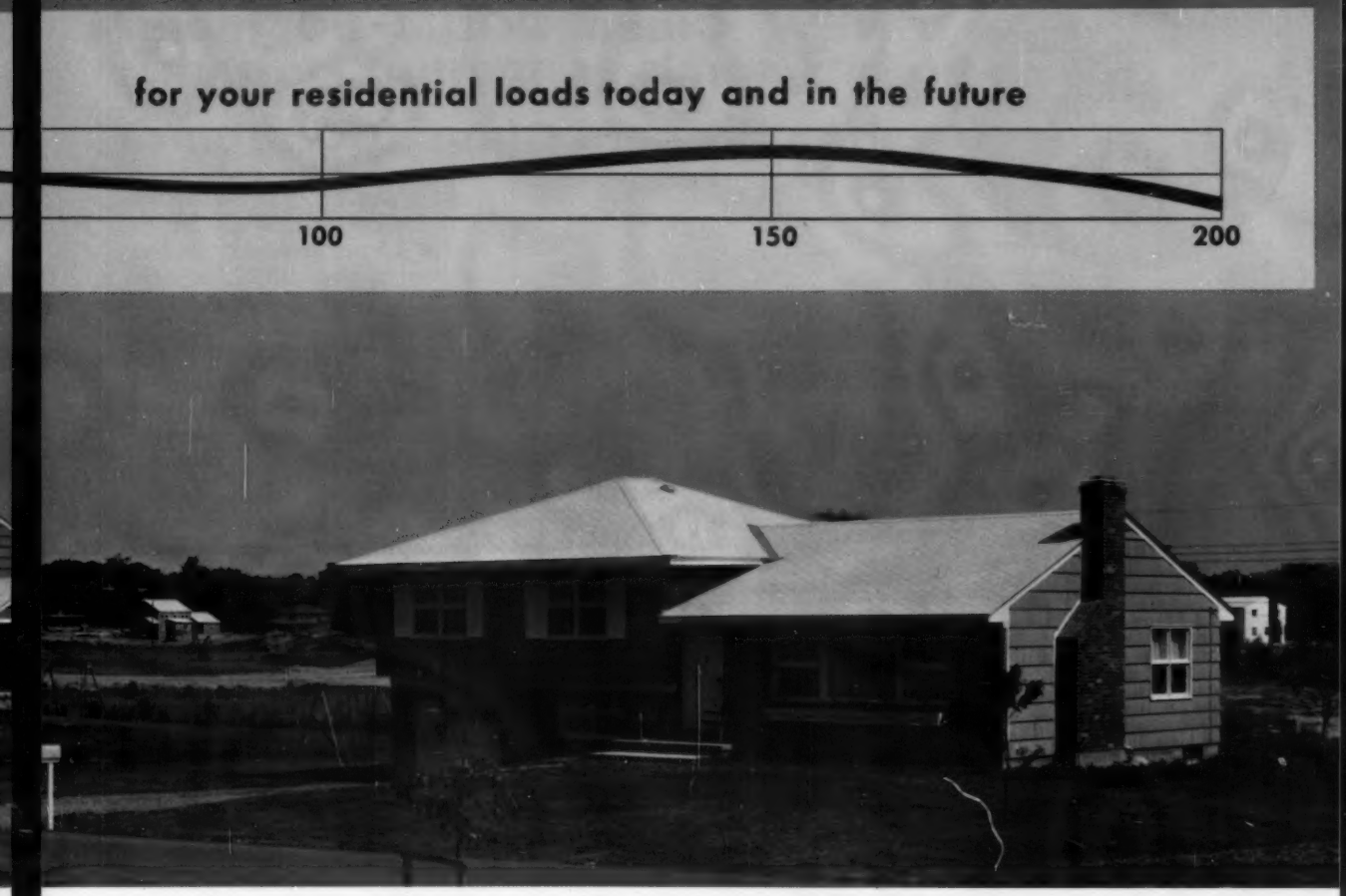



**FIG 5—TESTS RESULTS for 120-kv substation show agreement between analog-computer and synchronograph methods**


NEW
General Electric
I-60 Meter
TYPE I-60-S
GENERAL ELECTRIC
SINGLE-STATOR WATTHOUR METER
KILOWATTHOURS
CL 200 240V 3W 60~ TA 30
R. 13⅓ 720X1G1 K. 7.2
•00 000 000•
Now you can accurately measure residential loads to 200 amperes with this one watthour meter

# NEW General Electric I-60 Meter Offers You True "On-line" Accuracy All the Way to 200 Amps

## for your residential loads today and in the future




**FOR YOUR SINGLE-PHASE RESIDENTIAL LOADS,** the new Class 200 I-60 watthour meter by General Electric gives you "on-line" accuracy at *both* light and heavy loads. This remarkable new meter was designed specifically to meet the expressed needs of metering men for a single-stator meter capable of accurately measuring loads *up to 200 amperes* with a metering investment *no greater* than for existing Class 100 meters.

**PROVEN ACCURACY, UP TO 200 AMPERES,** is shown by the "on-line" load curve of the I-60 meter. The outstanding characteristic of the I-60 meter is its "on-line" performance at the Class 100 meter test currents of 1.5 and 15 amps, as well as at the Class 200 test currents of 3 and 30 amps. And at a full 200 amps it stays within three-quarters of one per cent. This superior performance of the I-60 is unequalled in the history of metering.

**YOUR METER INVESTMENT IS PROTECTED,** now and in the future, by the low inherent cost of the I-60 Class 200 meter—an inherent cost no greater than existing Class 100 meters. A revolutionary new, lightweight stator, simple and efficient, contributes to the outstanding accuracy of the I-60 meter. This stator design allows you to benefit from substantial savings in construction and materials selection. With the I-60, you protect your important metering investment by getting a Class 200 meter *genuinely no more costly* than present Class 100 meters.

**TIME-PROVEN ADVANTAGES OF MAGNETIC SUSPENSION**—a General Electric development—give you greater sustained accuracy, freedom from bearing replacement, and virtually eliminate tilt-error problems. Only G-E meters with magnetic suspension bring you these benefits.

*Whether you prefer Class 100 or 200 meters, General Electric has a meter to meet your needs. Ask your G-E Apparatus Salesman or Representative for all the facts on the new I-60. Write for bulletin to General Electric Co., Section 621-11, Schenectady 5, N. Y.*

LIVE BETTER ELECTRICALLY

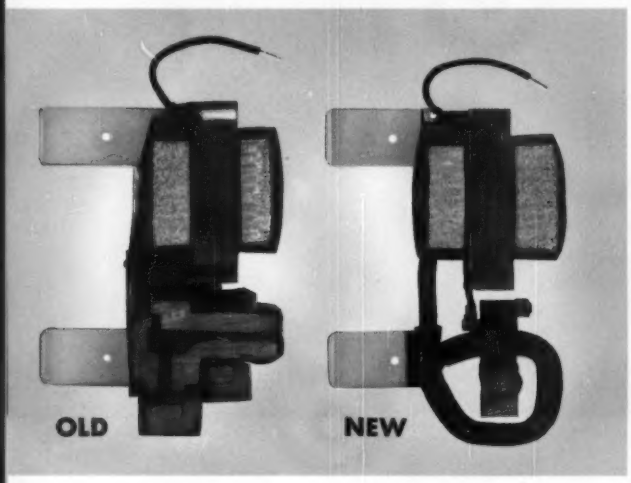
**GENERAL ELECTRIC**

*NOW FROM GENERAL ELECTRIC*

# NEW Class 200 I-60 meter is inherently no more costly than present Class 100 meters

## UNIQUE NEW STATOR CUTS MATERIAL COSTS IN CLASS 200 I-60 METER

A revolutionary new, lightweight stator design is incorporated in the I-60 meter, making its inherent cost equal to existing Class 100 meters. Comparing this I-60 stator to conventional Class 200 designs, there are substantial savings in copper and iron. Compromises in core designs and materials are eliminated by the simplified current coil and magnetic isolation of current and potential electromagnets. Spacing the potential-return laminations away from the current core eliminates undesirable intermingling of potential and current fluxes. Thus each electromagnet can best perform its measurement task.




The new current coil design is very simple compared to conventional split-coil designs found in other Class 200 meters. The elimination of current splitting minimizes error torques, inherent temperature errors, potential circuit losses, and undesirable effects on the phase angle of the potential flux. The new I-60 current coils are not fastened to the current core. Their new location and configuration permit optimum alignment of terminal blades in socket clips without affecting calibration. This creative engineering makes possible the I-60 meter's unprecedented accuracy all the way up to 200 amperes.

## NEW I-60 OFFERS MAGNETIC SUSPENSION AND OTHER I-50 METER FAMILY BENEFITS

The benefits of magnetic suspension—a General Electric exclusive—are yours in the I-60 meter. With magnetic suspension, G-E Class 100 and 200 meters offer greater sustained accuracy, freedom from bearing replacement, and virtual elimination of tilt errors. Other I-60 features time-proven in the I-50 meter family are corrosion resistant finishes, coordinated insulation, and easy-to-read faceplate.

*For complete details on Class 100 and 200 meters contact your G-E Apparatus Salesman or Representative or write General Electric Company, Section 621-11, Schenectady 5, N. Y.*

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

# Transfers Current at Hinge End of Switch

A novel method of current transfer has been introduced by Line Material Industries for their 115 and 161-kv air break switches. The method, developed for use at the hinge end of the blade on vertical-break insulator switches, shows promise of being applicable wherever current must be passed between moving parts.

Hub of this sealed current-transfer method is the interchange contact. A coil of silver-plated, beryllium copper, formed into a loop, is inserted between adjacent moving parts of the switch. Held in a confined space by a vee-shaped groove, the coil must tilt as illustrated in section "A-A" of Fig. 1. Contact pressure is developed by the resistance of the beryllium-copper coil to this tilting action. The result is a large number of parallel current paths distributed over a broad area at each transfer point.

Contact is continuous during all stages of opening or closing.

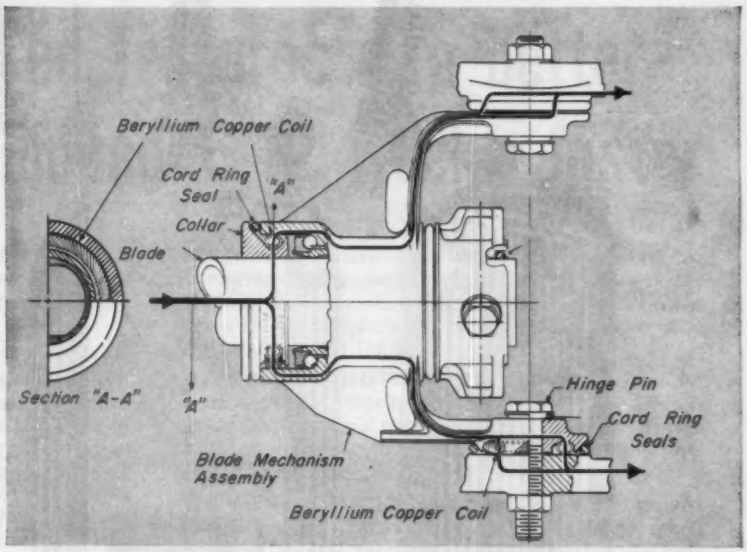



**FIG 1—CUTAWAY SKETCH shows current path through the switch blade mechanism of 115-kv switch. Section "A-A" illustrates how coil must tilt in operation**

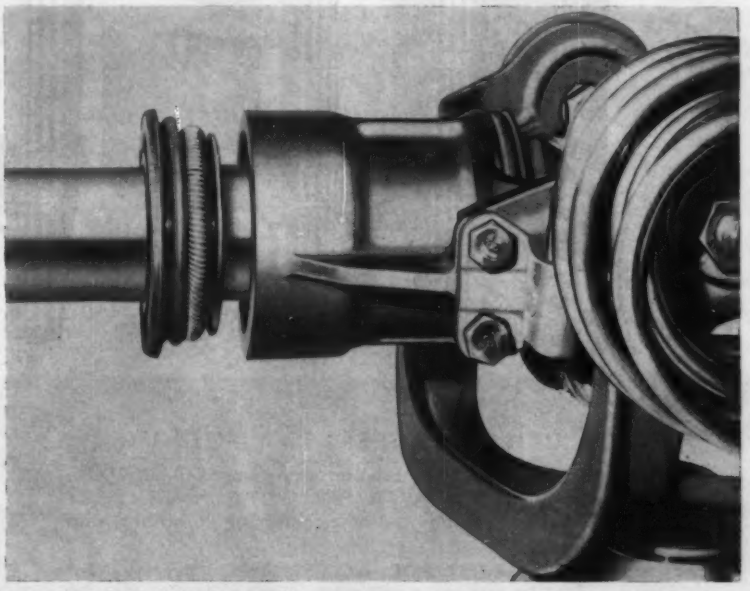


**FIG 2—115-KV SWITCH BLADE is partially removed from blade guide to show how current transfer is made with silver-plated beryllium copper contact**

### Performance Excellent

The current path starts at the blade and passes to a permanently bonded collar and thence through the first interchange contact to the blade mechanism assembly. The current divides and flows toward the hinge points where twin interchange contacts transfer it past the hinge pins into the main frame.

Overall performance, particularly short-circuit current capacity, is excellent, and all NEMA requirements are exceeded by a substantial safety factor. Magnetic forces and temperature rise are reduced to negligible amounts by the large number of parallel paths.

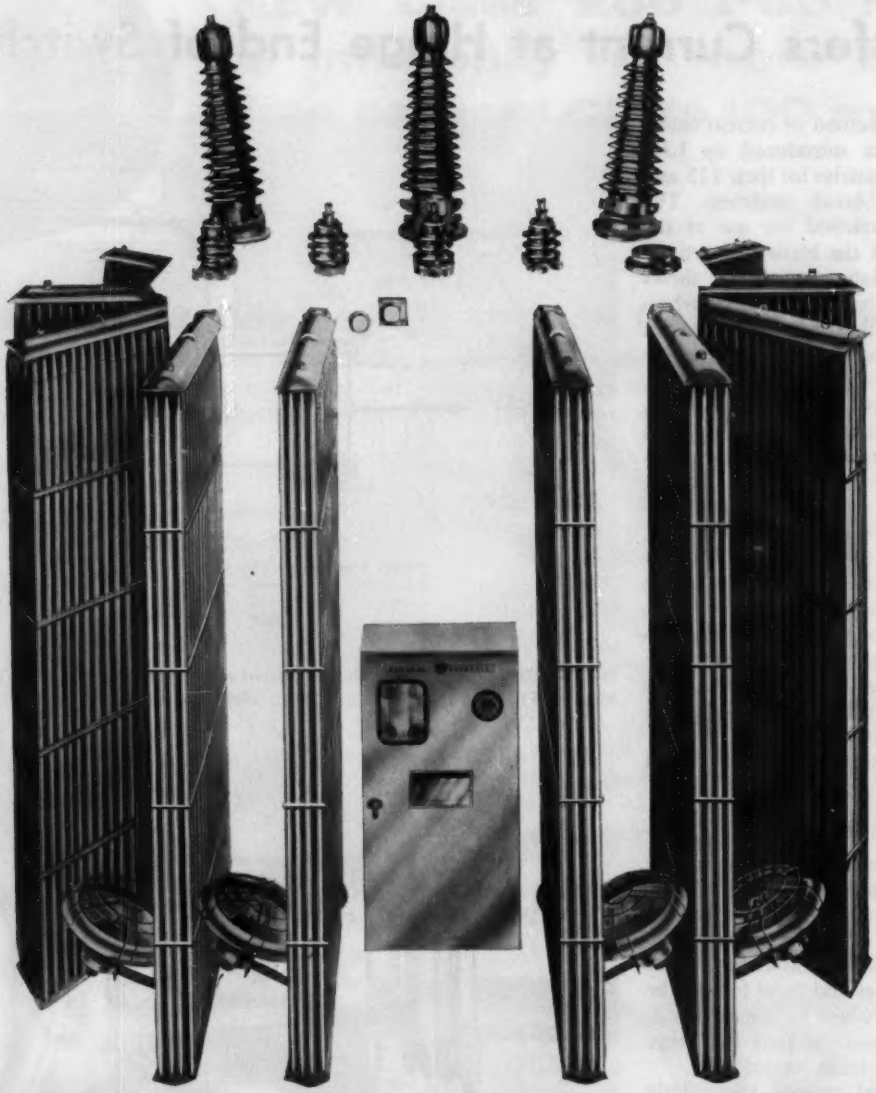
The contact assembly is lubricated and sealed with silicone grease and cord rings. A long life of maintenance-free operation is assured.

Several advantages are obtained from the enclosure of contacts at the hinge end of a switch blade. Ice-breaking ability, percent of operating effort applied to the contact end of the blade, clearance around the hinge mechanism, and rigidity of the mechanism structure are all enhanced. These features are especially important on larger switches.

Apparently, this current-transfer method is applicable for grounding the operating pipe of gang switches, elimination of flexible braid giving the pipe freedom of rotation.

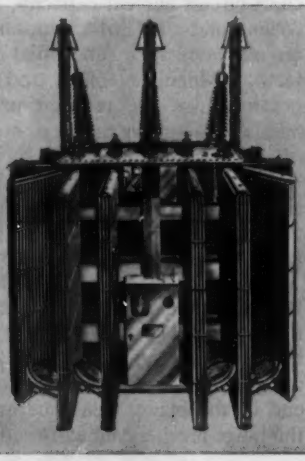
(*More How To on page* 100)

## NEW FROM GENERAL ELECTRIC:



**TYPICAL UTILITY-PREFERRED PD FEATURES:**

- **COOLING:** Location of cooling equipment for self-(OA), fan-(OA/FA and OA/FA/FA), or forced-oil-cooled (FOA) units provides easy access for handling and maintenance.
- **CONTROL CABINET FOR ACCESSORIES:** Eye-level location simplifies operation and maintenance.
- **BOLTED COVER:** Reusable Nitrile rubber gaskets help keep domed cover liquid- and gas-tight.
- **BUSHINGS:** All are ASA-standard.
- **LTC:** Proven reliable load tap changer has hinged doors and is shipped in place.
- **NO-LOAD TAP CHANGERS:** Single, floor-level operating handle is used.



## PREFERRED DESIGN* POWER TRANSFORMERS

# Utility-preferred features in a better transformer, shipped 6-12 weeks faster

A new line of power transformers—called Preferred Design—available from General Electric, offers unprecedented advances and advantages to the utility industry.

Designed to fulfill the vast majority of your requirements for three-phase transformers in any kva rating up to and including 50,000 kva (maximum rating), this new family of PD units is available in OA, OA/FA, OA/FA/FA, and FOA types, and in 69-, 115-, and 138-kv classes with and without load tap changing. The line incorporates features carefully selected after extensive surveys and analyses of industry practices and preferences. Here are just a few of the tangible benefits to users of PD transformers:

**BETTER TRANSFORMERS,** with extraordinary flexibility in electrical characteristics, result from the application of a 705 Electronic Data Processing Machine to transformer design. This computer performs design operations up to 3800 times faster than hand methods, makes more precise and comprehensive calculations, and helps provide the optimum design for each application.

**APPROVED CONSTRUCTION DRAWINGS** will be sent *with the proposition* on all Preferred Design transformers. This speeds utility substation design and construction, helps you cut costs by eliminating delays.

**SHIPMENT 6 TO 12 WEEKS SOONER** is standard practice with PD transformers, because the speed of the 705 eliminates weeks of laborious engineering calculations.

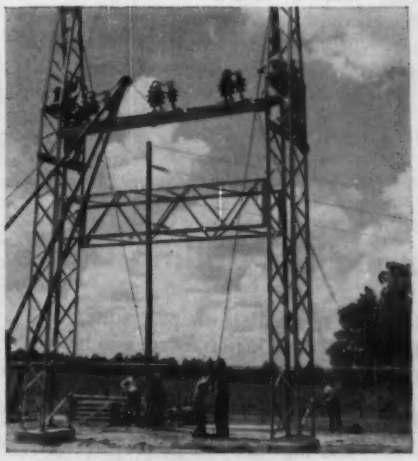
**COMPLETE INFORMATION** can be obtained by contacting your G-E Sales Engineer or by writing to Section 426-1, General Electric Company, Schenectady, N. Y.

*Preferred Design (PD) power transformers contain features which, based on surveys of electric utilities, have an average acceptance of 86%.

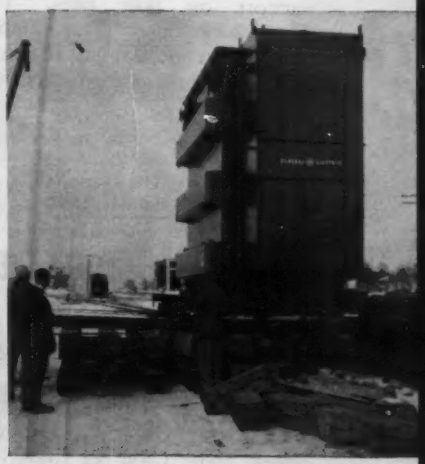
*Progress Is Our Most Important Product*

GENERAL ELECTRIC

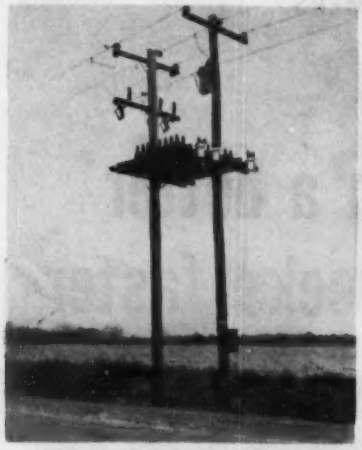
**BETTER TRANSFORMERS** result from optimizing of designs by new IBM-705 computer.



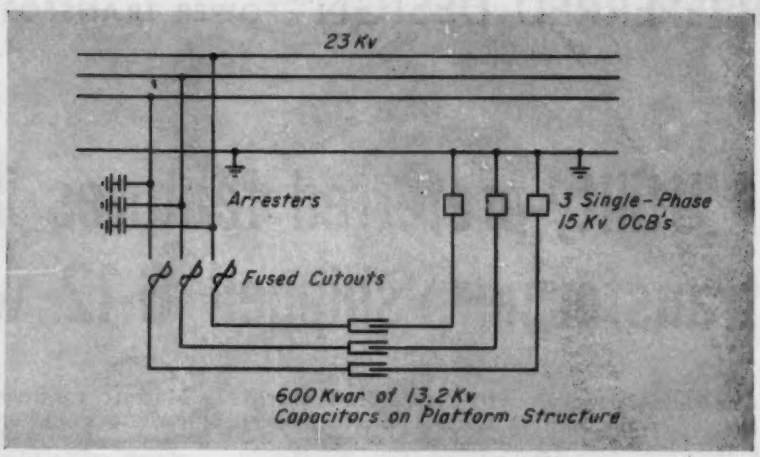
**CONSTRUCTION DRAWINGS** submitted with propositions will speed your construction, help cut your costs.



**6 TO 12 WEEKS FASTER SHIPMENT** is standard on all Preferred Design power transformers.



**TWO-POLE PLATFORM** contains 600-kvar bank of 13.2-kv-rated capacitors




**15-KV OIL SWITCHES** automatically control 23-kv capacitor installations on poles, the switches being connected between neutral side of bank and ground

# Control 23-Kv Capacitor Banks Economically

**WAYNE BURCH**, Operating & Engineering Dept, Carolina Power & Light Co, Raleigh, N. C.

Inexpensive 15-kv oil switches have been adopted by Carolina Power & Light Co for automatically controlling 23-kv capacitor installations on poles. Adoption followed two years' satisfactory operation.

These switches are connected between the neutral side of the capacitor bank and ground. The other side of the capacitor bank is connected through fuse cutouts to the hot primaries.

Use of the 15-kv oil switches stems from an investigation to find a cheap method of controlling capacitors on pole lines. These 23/13.2-kv lines are relatively long and do not have line regulators, although there are regulators at some substations. At a few substations without regulators the bus regulation was negative or poor. Because of this and the gradually increasing line regulation, some correction was needed.

Capacitors were added continuously at substations to supply reactive. At very little additional cost, it was believed, some capacitors could be installed on the lines to improve the voltage, without investment in regulators.

### Prove Satisfactory

The investigation indicated that 600-kvar capacitor banks on two-pole platforms would be most satisfactory and economical. Capacitors rated at 13.2-kv were available and could be connected between the hot primary and multi-grounded neutral. But there was no cheap, suitable switch available at the time.

Manufacturers of available 15-kv single-phase oil switches, for controlling capacitors were consulted on the feasibility of installing the switches between the capacitor and ground. Trial installations were approved.

In the adopted scheme, one side of the capacitor bank is connected permanently to the hot line through fused cutouts which disconnect the capacitors when trouble occurs. The other side of the bank is connected through the oil switches to the multi-grounded neutral.

Seven banks have been installed since September, 1955. Six have voltage control, and one has time-switch control. All banks operated without failure of capacitors or oil switches, and no other operating problem has been experienced.



# Small Parachute Expedites Pulling Cable Through Pipes

A small parachute helped electricians pull 210 ft of heavy cable through each of 13 core dent pipe lines at the shopping center at Morrisburg, Ontario. The cable weighs about 1 ton per 1,000 ft.

A small cloth parachute, with a ball of string attached, was blown by compressed air through the length of pipe. Then a length of haywire was attached to one end of the string, and the wire was pulled through the pipes. Next a ¼-in. rope was similarly attached and hauled through.

In the final operation, the 1½-in.-dia cable, with a pulling stocking on one end, was pulled through the pipe by means of a winch truck.

ENGINEERING LEADERSHIP
KEY TO ATOMIC PROGRESS

# General Electric engineers combine high power and flexible experimental space in new test reactor

A major advance in reactor technology was made by General Electric engineers and scientists in designing and developing the new 30,000-kw General Electric Test Reactor (GETR).

A new concept in test and research reactors, the GETR permits a wide variety of simultaneous high-flux experiments to meet the needs of a diversified research program. The advantages of high specific power in a tank-type reactor and the large, easily accessible experimental space of a pool-type reactor are combined in the GETR.

The first GETR will be installed at the General Electric Vallecitos Atomic Laboratory. General Electric will use the reactor for fuel development and general research programs. Experimental space will be available for other organizations within the industry. The design and development of this new reactor is another example of General Electric engineering leadership in the field of atomic energy. Atomic Power Equipment Department, General Electric Co., San Jose, California.

136-9

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

# "We avoided costly service calls and saved our customers irritating shutdowns .. *by equipping welders we sold with Fusetron Fuses*" . . . .

*Frank Korinek,* OWNER
SUN RAY ELECTRIC COMPANY
CHICAGO, ILL.

*Mr. Korinek continues . . .*

"About a year ago my motor rewind shop bought 62 welders for resale from a surplus dealer.

"They were 300 ampere arc welders, with the A.C. motor directly connected to a 300 ampere D.C. generator. The motor has a speed of 3500 R.P.M. and a nameplate rating of 56 amperes at 220 volts.

"The welders were equipped with 60 amp., 250 volt fuse clips. However, when we ran the welders in the shop, we found that ordinary 60 amp. fuses would blow on the starting current of the motor.

"We then tried 60 ampere Fusetron dual-element fuses. They proved to hold the starting current and to give the needed protection to the motor and generator.

"We are glad we had this experience in our own shop and installed Fusetron fuses before selling the welders. Otherwise, we would have had a flock of costly unnecessary service calls and run the risk of losing customers.

"As it happens, our customers are satisfied with the performance of the welders and we haven't had a service call or complaint about needless fuse blows."

***FUSETRON dual-element FUSES do more than eliminate needless blows. They give 10 point protection not available with any other type of protective device.***

## AND FUSETRON FUSES REMAIN SAFE THRU THE YEARS . . .

*. . . without maintenance and recalibration costs.*

Once properly installed, Fusetron fuses require no costly inspection time or maintenance necessary on mechanically operated devices.

Dust, fumes, corrosion or age cannot prevent a Fusetron fuse from opening safely. There are no hinges, pivots or contacts to stick or slow down the operation of the fuse on short-circuits.

When a Fusetron fuse does open to protect, and after the fault has been corrected—the new Fusetron fuse you install has been calibrated at the factory by engineers—it is a fuse as safe and dependable as the one that blew.

**DON'T RISK LOSSES!** *One needless shutdown . . . one lost motor . . . one destroyed switch or panel . . . one burned out solenoid . . . may cost you far more than replacing every ordinary fuse with Fusetron dual-element fuses. Write for bulletin FIS.*

**For loads above 600 amps.—Use BUSS Hi-Cap Fuses to coordinate your electrical circuits.**

*On 600 volts or less, BUSS Hi-Cap fuses have an interrupting capacity sufficient to handle any fault current regardless of system growth.*

*They can be coordinated with Fusetron fuses on feeder and branch circuits to limit fault outages to circuits of origin. Write for bulletin HCS.*

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

**Bussmann Mfg. Division**
McGraw-Edison Co.
University at Jefferson, St. Louis 7, Mo.

***Play Safe! Install Fusetron dual-element fuses and BUSS Hi-Cap Fuses throughout entire Electrical System!***

1057

# Electric Light Grows Pom-Poms in Florida

## Flower farmers do a thriving business, turning out more and better chrysanthemums with 'round-the-clock artificial light

**LOWIS CARLTON,** Publicity Assistant, Florida Power & Light Co, Miami, Fla.

Electricity is improving quality and output in flower farming, one of Florida's up and coming young industries. Burning lights at night is widespread practice here, to promote and regulate growth and blooming.

Latest census figures showed a 59% increase from 1949 through 1954 in Florida's dollar volume of sales of flowers, greenhouse and nursery products. The 1954 total of $27½ million was more than double that of Texas, the next state, and topped 12 other Southern states.

Growing most rapidly of all is the six-years-young pom-pom chrysanthemum business. With only 219.4 acres under cultivation, almost 55 million bunches were produced in one year—about one bunch per foot.

### No Greenhouses Needed

Their superbly long stems and perfect blossoms are the result of correct application of electric light during the growing period. Mild Florida weather makes it possible to eliminate greenhouses and grow them outdoors.

One of the most thriving pom-pom farms is Burdette, Coward & Co near Punta Gorda on Florida's west coast. During six years of operation, ground under cultivation has been increased by 12 times. This farm is now Florida Power & Light Co's largest commercial customer in that area.

A 13,000-v rural line was built to serve the farm, which has a peak demand of 246 kw. Three 100-kva transformers are required. A neighboring farm specializing in corn and gladioli also uses the facilities.

### Will Grow Two Million

This year's planting schedule calls for two million pom-poms to be grown from rooted cuttings shipped in from Ohio. Planting starts in July and continues every week until the following February so that a group is always ready for shipment.

The plants go into beds 42 in. wide by 150 ft long, covered by 7x8-in. squares of wire mesh. As they grow, the wire is moved up to support them.

From the time the plants go into the ground, lights are turned on at night to speed their growth. Eight 600-amp contactors work off a time clock, which turns on the lights automatically.

Burdette, Coward & Co now has 3,300 reflectors and 100-w bulbs which go on at 10 p.m. and burn for whatever length of time each group of plants needs for finest growth.

"To see thousands of lights, row upon row, out in the middle of a farming area, is a startling sight. We have continual inquiries from Florida visitors who can't figure out the reason for so much illumination," said Mr. Coward.

Eight major service lines run into the 18-acre flower-growing area with more than 400 lights on each of eight circuits. One 100-w bulb is allowed for each 50 sq ft of space. While the service lines are permanent, reflectors are on extension lines and are moved from one bed to another.

This firm raises everything from small button-type pom-poms to large football-corsage sizes. They have a rainbow of hues—white, red, bronze, yellow, pink. Some of the blooms measure six in. across.

### Kwhrs Help in Many Ways

The progressive management is using electricity in other ways to increase efficiency of operation. An electric stitcher and a tying machine package a box of pom-poms in 30 sec. An electric spray pump with a 20-hp electric motor sprays insecticides. Two 10-hp electric pumps service two fields with overhead irrigation, fed from a creek and a man-made lake.

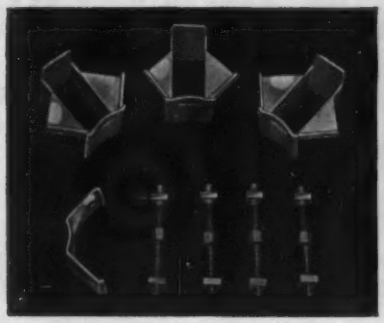
Said Mr. Coward, "All this electrical equipment, and especially the lights, helps the farmer cut down chances of losing a crop. It also insures that every crop will be top quality and bring top prices on the market."

(*More Selling on page* 108)

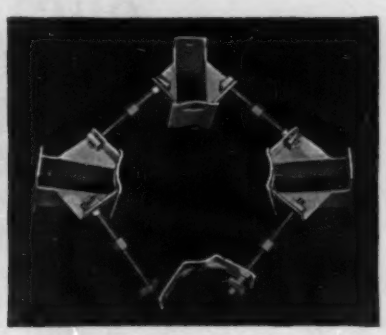
# Now one transformer mount fits all poles 6½ to 16 inches in diameter!

## New Hub-Mount* takes all EEI-NEMA Transformers 3 kva to 167 kva in one, two, three combinations

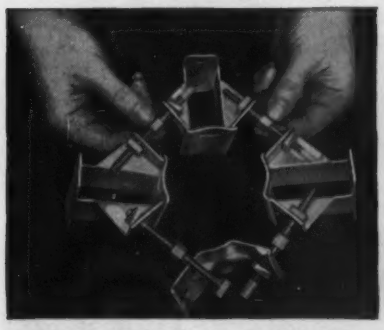
## Working scale model demonstrates ease of assembly!



**1. HUB-MOUNT** assembly is made up of 1, 2 or 3 mounting boxes and quarter plates plus 4 turnbuckle-type bolts. Connecting bolts are fabricated from Cor-Ten steel for long service life. In tests, Hub-Mount has supported more than three times the weight of three 167 kva transformers without any visible deformation!

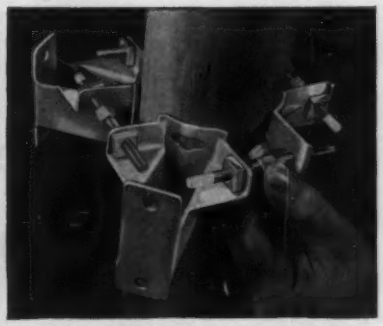


**2. GROUND ASSEMBLY.** With so few parts, assembly is simple, trouble-free. Left hand bolt threads and nuts are color-coded to speed assembly by eliminating trial and error. Hub-Mount's all steel design eliminates carpentry, periodic maintenance present in platform construction.

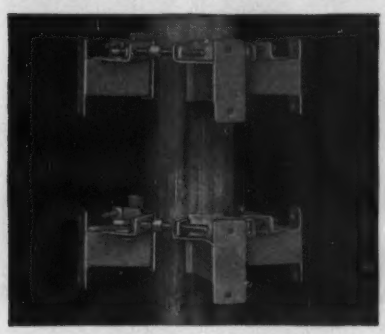


**3. GROUND ADJUSTMENT.** Turning downward on hex section of turnbuckle bolts adjusts size of Hub-Mount to pole diameter at the point of installation. Hub-Mount has only four points of adjustment. By adjusting three of them on the ground, it is only necessary for the lineman to wrench at one point on the pole.

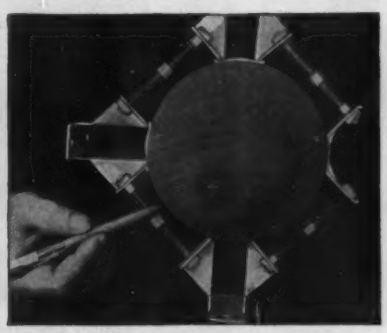
**4. MOUNTING.** Hub-Mount is lofted to the pole, hung from one lag screw driven into the pole at the desired height. This leaves the lineman entirely free to complete the installation, by connecting open turnbuckle bolt to quarter plate. Lineman makes his installation from one point on the pole!



**5. FINAL ADJUSTMENT.** Wrenching downward on the hex section completes installation. When installed, Hub-Mounts work in compression, are not loosened by pole shrinkage. The weight of the transformers causes the Hub-Mount to bind on the pole, thereby maintaining a tight grip.



**6. READY FOR TRANSFORMERS.** This simple, flexible arrangement accommodates all EEI-NEMA transformers from 3 kva to 167 kva in combinations of one, two or three. Hub-Mount's exclusive design places no reliance on welds, which work in compression, do not govern available strength.



**7. WRENCH CLEARANCE.** Note wrench clearance at maximum adjustment on 16 inch pole diameter.

*Patent Pending

# HUBBARD
## AND COMPANY

Pittsburgh 1, Pa.
Chicago, Ill.
Oakland, Calif.
Plano, Texas

# PRIMARY UNIT SUBSTATIONS

# CUSTOM BUILT FOR YOU —AT NO EXTRA COST

Here at I-T-E, complete primary unit substations are custom designed and engineered to meet your particular requirements. I-T-E engineers skillfully knit together quality I-T-E substation components in a way to give you the advantages of versatility, reliability, safety and convenience.

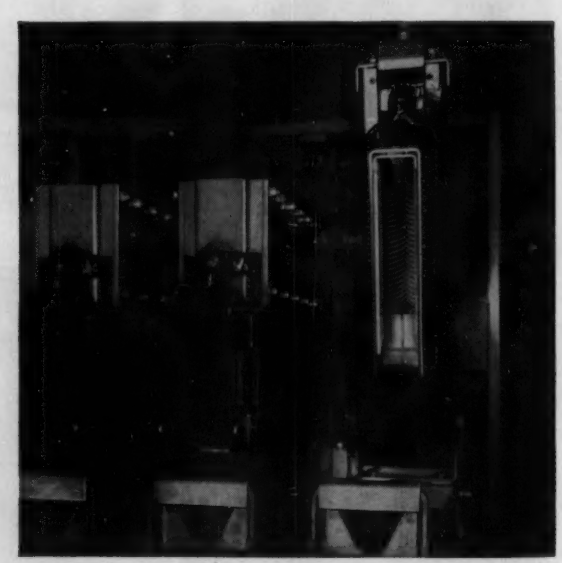
Particular emphasis is placed on ease of installation to meet all your requirements for growth and relocation, with full regard to an appearance that fits well into your surroundings.

Typical I-T-E quality manufacturing standards further insure that your substation will give you the maximum reliability and performance at the lowest cost. Delivery can be made in accordance with your own construction schedule. You can save time, trouble and money in completing the final job.

I-T-E primary unit substations are available for any application and in any standard rating. For details, call the I-T-E sales office near you. Or write I-T-E Circuit Breaker Co., 19th & Hamilton Sts., Philadelphia 30, Pa.

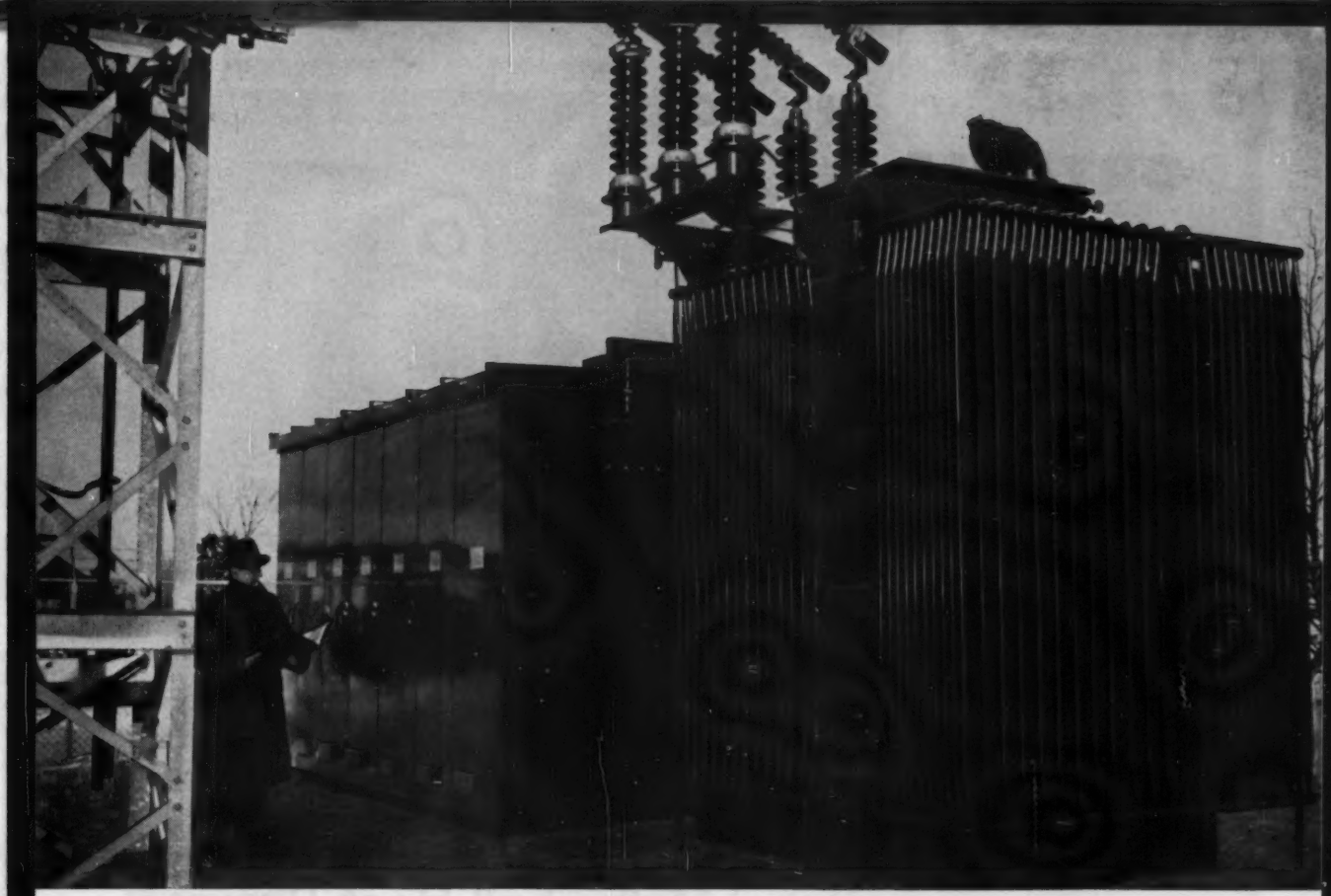
## Engineered to insure the best value

**Horizontal drawout air circuit breakers.** Even heavy 13.8-kv circuit breakers roll out easily on permanently attached wheels. Safety shutters automatically close over bus openings when breaker is moved to test position or from enclosure.

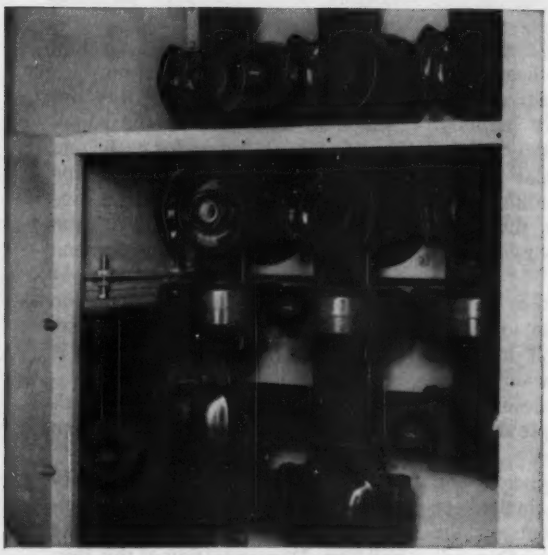


**Positive arc interruption.** Double coil, closed iron magnetic circuit produces intense magnetic effect, drives arc rapidly and uniformly between plates in arc chute, where it is extinguished, giving faster interruption, longer arc chute life.

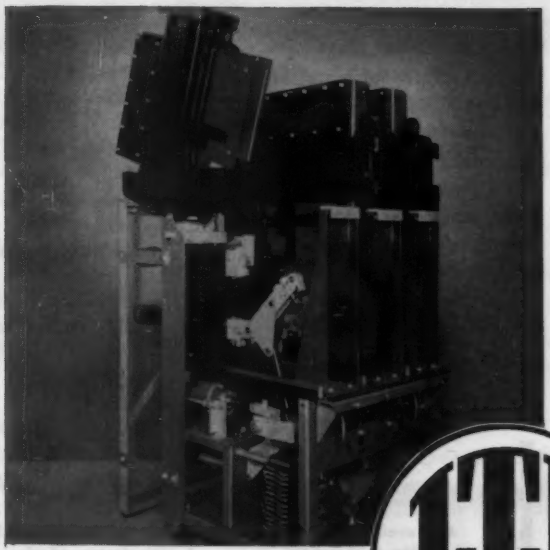
**I-T-E CIRCUIT BREAKER COMPANY—Switchgear Division**



# and the most reliable performance



**Fully isolated main bus with flame-retardant insulation.** Bus is held in alignment against short circuit stress by porcelain bus supports. Flame-retardant insulation covers entire bus, including porcelain primary disconnect housings.

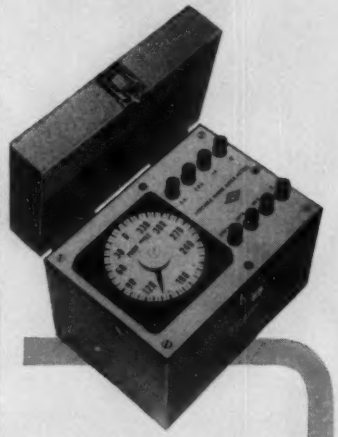


**Simplified maintenance.** Pivoting arc chutes simplify routine inspection and upkeep. Auxiliary devices are positioned to permit easy access.

I-T-E

IN CANADA: EASTERN POWER DEVICES LTD.

# PORTABLE PHASE ANGLE METER



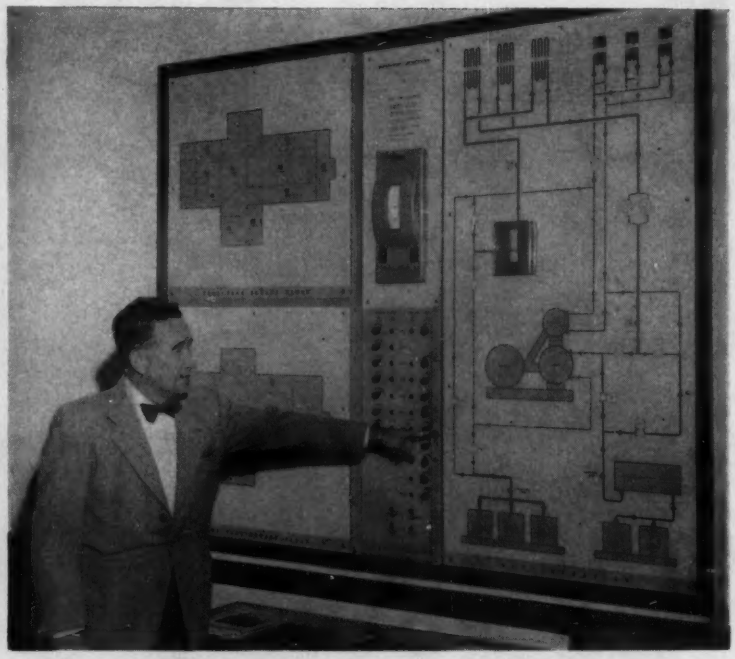
Completely self-contained, and requiring no auxiliary equipment for its operation, this Portable Phase Angle Meter offers a direct way of checking relay and instrument connections, particularly directional over-current relays, differential relays or similar equipment. It may also be used to measure the prevailing power factor in each phase of a polyphase watthour meter installation. The device has a frequency of 60 cycle, with voltage ranges of 60, 120 and 240 volt. Current ranges are 1, 2.5 and 5 amp. . . . DIMENSIONS: 9½ x 6¾ x 5⅝ in. Weight 19 lbs.

**Also available in other voltage combinations**

*Write for Bulletin #75 for complete information*

**EASTERN SPECIALTY CO.**
PHILADELPHIA 40, PA.



**By Showing Off Easy Temperature Control . . .**

# Panel Helps Sell Heat Pumps


**GILBERT D. LEACH, JR.**, Heating and Air Conditioning Engineer, Tampa Electric Co, Tampa, Fla.


The first supervisory data center for controlling a 200-hp heat pump has been installed in Tampa Electric Co's new main office building. It is the "brain" for the 200-hp water-to-water-to-air heat pump installation that air-conditions all of the building except the IBM area, which is handled by two 20-hp heat pumps.

The center is also used as a sales tool. It is located in the lobby of the building, where it will draw the greatest attention. Whenever a customer asks about it, a salesman explains how it works and provides information on heat pumps.

Air conditioning engineers and contractors have been invited to demonstrations that point up the simplicity of the scheme. One advantage emphasized is that trained mechanics need not be on call or available to make adjustments.

The supervisory data center consists of a 5x6-ft multicolored control panel. On this panel are floor plans showing the zones of the building, a schematic of the heat pump system, and remote-control devices for checking and adjusting the temperature in each zone.

The remote-control devices are located in the center of the panel. There is a push-button for each zone in the building and for four points in the water system. Pushing a button causes a meter to indicate the temperature of the appropriate zone or point in the water system. At the same time, a lamp lights on the floor plan or schematic to show the exact spot where the temperature is being taken. Beside each push-button is a control knob for adjusting the temperature in each zone individually.

These simple controls do away with the need for specialists to adjust temperature in each zone of the building. Demonstration of this simplicity, it is hoped, will help influence engineers and architects to put heat pumps in other buildings.


*(More Selling on page 110)*

# Do you worry about control circuit installation costs WHEN YOU'RE PLAYING GOLF?

*You shouldn't!* Why not concentrate instead on breaking 90?

Many of your control circuit installation problems, including the cost problem, can be solved if you'll specify and use Rockbestos PNR 600 volt control cable — the cable that's been proven over and over again through more than 14,000,000 feet of installations.

Here's why Rockbestos PNR is your best buy in control cables:

- With it you save on conduit and fittings, cut installation costs.
- Rockbestos PNR lets you pull a 12 conductor control cable in conduit which is now carrying ordinary six or seven conductor cable.
- It's 46% smaller in area — 28% smaller in diameter than conventional control cable.
- It's flexible from 167° to —67°F.
- It's light, easy to handle, pull through conduits.

Get the complete Rockbestos PNR story — write now for detailed specifications and application data.

**ROCKBESTOS PRODUCTS CORPORATION**

NEW HAVEN 4, CONNECTICUT

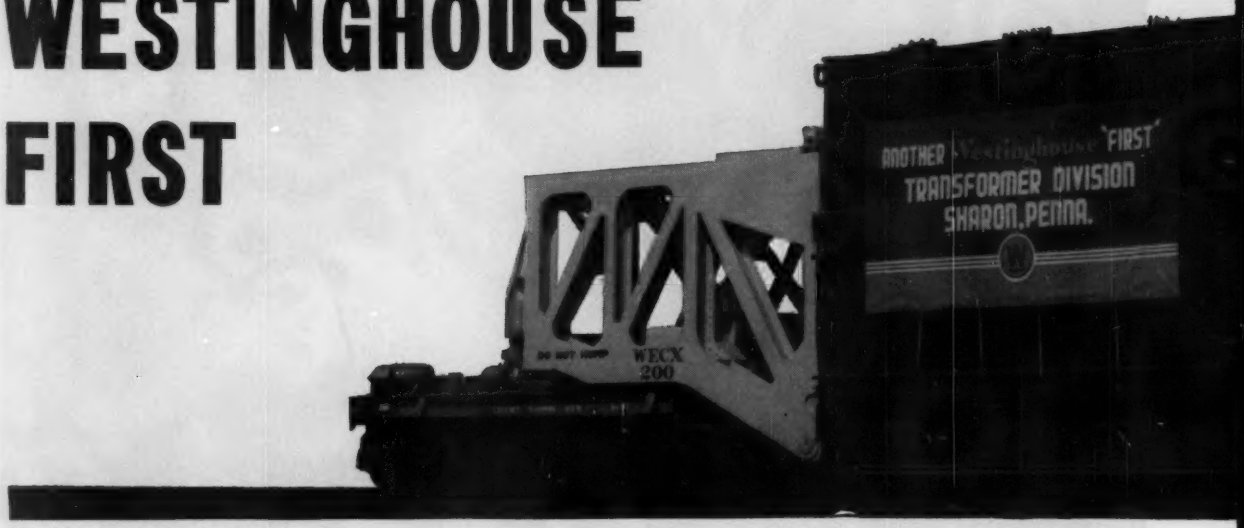
NEW YORK, CLEVELAND, CHICAGO, PITTSBURGH, LOS ANGELES, DETROIT, ST. LOUIS, ATLANTA, DALLAS, OAKLAND, SEATTLE

**ROCKBESTOS**

**PNR Small Diameter Control Cable**

MORE THAN 14,000,000 FEET IN SERVICE

# ANOTHER WESTINGHOUSE FIRST




## *NEW SHIPPING METHOD DELIVERS GIANT TRANSFORMER*

For the first time, a transformer has been shipped as part of its own railroad car! En route to the Ohio Power Company's Kammer plant at Captina, West Virginia, this 200,000-kva, 330-kv autotransformer became the center section of a revolutionary three-section railroad car—the nation's first car of this type.

Designed by Westinghouse and built by the Greenville Steel Car Company, the new car will permit transformers up to 250 tons to be shipped in one piece—upright, and without sectionalizing.

The new car consists of two identical end sections, with the transformer comprising the center section and suspended between trusses mounted on each end. Although the car is 90 feet long when

## AS PART OF CAR, REDUCES INSTALLATION TIME AND COST

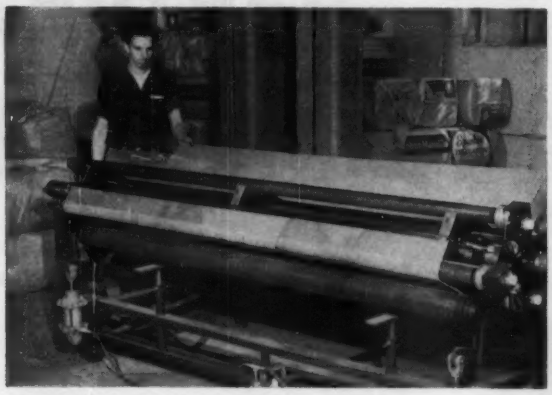
loaded, it can negotiate the same curves as a standard boxcar. The result: direct routing, helping to speed your construction schedules.

The combination of this new shipping method and Westinghouse "Form-Fit"® design provides a sure means of producing transformers with ratings adequate for future needs. Utilizing basic shell-form design with the core surrounding the coils, Form-Fit design provides a more compact transformer with superior mechanical and dielectric strength, greater thermal capacity—the highest rating-per-pound available. The new railroad car adds *extra* growth potential to this "room-to-grow" design, by providing assured delivery for your higher capacity transformers of the future. J-70828

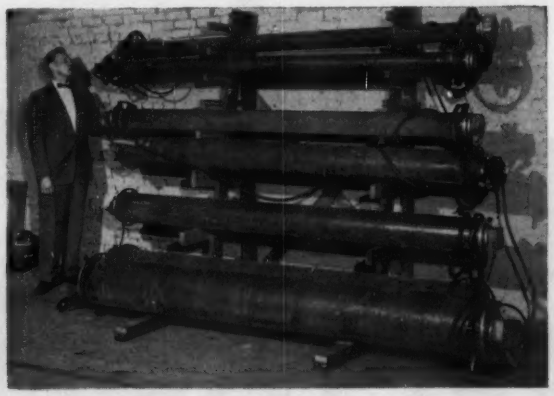
YOU CAN BE SURE...IF IT'S
Westinghouse

The new railroad car can support its load only six inches above the rails—two feet lower than on a depressed-center car. For this delivery, top clearance was sufficient to permit suspension a full foot above the rails.

Untight squeeze—loaded on the new car, this transformer for Ohio Power Company stands 19'2" above the rails; bridge clearance here is 20'4"; net, 14" top clearance. This allows direct routing, speeds delivery and construction schedules.



**Flexible bending machines . . .**



**with electrically heated rolls . . .**

# Form Plywood, Hardboard To Tricky Shapes

**A. J. CHIODINI** and **B. A. MERRITT**, Industrial Engineers, Union Electric Co, St. Louis, Mo.

Electrically heated machines are bending fiberboard and plywood into tubes, corrugations, U-shapes, and other complicated, tricky forms at the Midwest Manufacturing Co in Webster Groves, Mo. Using uniform pressure and electric heat, the machines handle a wide variety of materials, including standard or tempered hardboard up to ¼-inch thick, plywood to the same thickness, and new products such as teakwood and Plyveneer. All fiber wallboards, insulating boards up to ½-inch thick, and laminates of plywood with metal facings are also easily bent.

The easily controlled machines produce uniformly good results. Simple and rugged they require very little maintenance. In addition, they are safe and clean.

### Machine Bends Plywood 180 Degrees

Developed by Midwest when gas-fired equipment proved inadequate, the machines use cartridge-type heaters for small bending rolls and open coil heaters on the larger rolls. Heating zones may be as little as 120 degrees or up to 360 degrees of surface over the entire length of the roll.

One machine, with a 5-kw, 240-volt, single-phase heating elements, can bend ¼-inch hardboard or plywood as much as 180 degrees. Using a 48-inch roll with a 2-inch radius, it applies uniform heat all along the board at the line where the bend is momentarily being made. Pressure and heat creep along as the machine performs its bending operation.

The operator inserts the moistened material into the machine. He then trips a lever which allows the counterweights under the bench to advance the bending roll smoothly and automatically. After the bend is completed, he returns the bending roll to its original position, removes the finished piece, and starts over.

Thermostatic control from 220 F to 550 F works with a synchronous percentage input controller to maintain the correct temperature for each material. Hardboard can usually be bent 90 degrees in 15 to 45 seconds, depending on the thickness.

Newest addition is a machine that bends hardboard into columnar forms for reinforced concrete building construction. Four 90-degree bends are made by four strokes of an air cylinder which drives a geared wheel through a ratchet mechanism. The machine turns out 21 perfect tubes, 8-feet long, per hour.

The bender has a revolving reel of four 2.5-inch o.d. bending rolls. Each roll has a 5-kw cartridge heater with its own thermostat for individual temperature control between 200 F and 500 F. Three-phase slip rings at one end supply power to the reel.

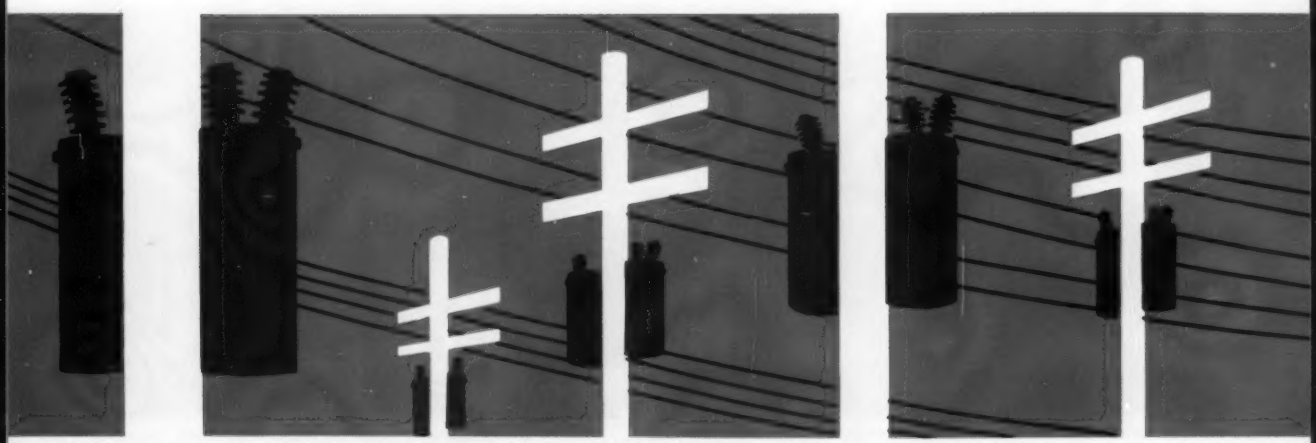
Other shapes produced on the machines are hi-fi speaker enclosures, contoured and ventilated backs for TV sets, corrugated sheets 4 x 8-ft.

Midwest started operations in Cleveland in 1943, using gas-fired equipment. Primary business then was bending hardboard into fluorescent lamp reflectors. The gas-fired equipment was limited to simple bends and heat control was a problem.

**PRODUCTS INCLUDE hi-fi speaker enclosure, 4 x 8 corrugated sheets hobby horse saddle, contoured back for TV set**

# DELTA-STAR INTRODUCES

## a complete line of modern distribution transformers



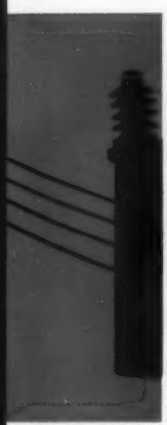
SINGLE PHASE, 3kva to 167kva, 15,000 volts and below

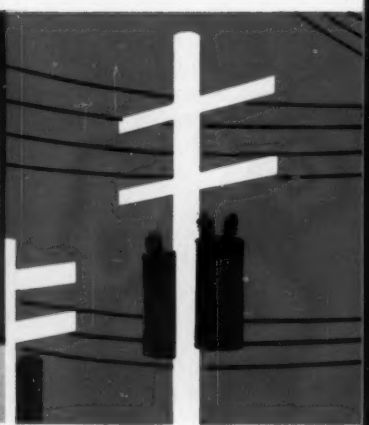
**H. K. PORTER COMPANY, INC.**

DELTA-STAR ELECTRIC DIVISION

# Modern from every standpoint, . . .

**Available in all NEMA ratings . . .**
**3kva, 5kva, 10kva, 15kva, 25kva,**
**37½kva, 50kva, 75kva, 100kva,**
**and 167kva.**





Potentiometric titration test (above) determines neutralization point, while cloud and pour tests measure low-temperature limitations of the inhibited dielectric oil used in all Delta-Star Transformers. ASTM methods are used on all basic materials.

**H. K. PORTER COMPANY, INC.** DELTA-STAR ELECTRIC DIVISION

# ... DELTA-STAR TRANSFORMERS* offer outstanding quality, serviceability, and economy

The extensive experience of Delta-Star engineers in power and distribution equipment has produced an entirely new and complete line of pole-type distribution transformers, built to NEMA standards.

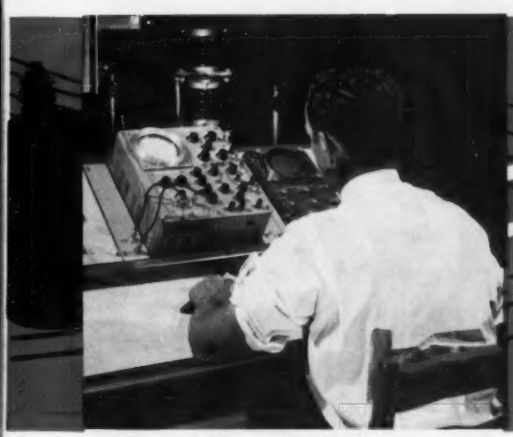
Delta-Star Transformers, in single-phase ratings from 3kva to 167kva, in standard voltage through 15,000v, are new in every detail. The latest production and testing methods and equipment are used to assure that, from the inside out, every Delta-Star Distribution Transformer meets rigid Delta-Star design specifications.

Some of the new improvements which contribute to the small size, light weight, and easy maintenance of Delta-Star Transformers: A new core, a smaller coil, improved insulation, corrosion-resistant tank design, and a high-strength easily-stacked shipping crate.

## SEND FOR CATALOG

For complete information on the new Delta-Star Transformer line, get the new 16-page illustrated catalog. Drop a card to H. K. Porter Company, Inc., Delta-Star Electric Division, 17th & Cambria Sts., Philadelphia 32, Pa.

*** PATENTS APPLIED FOR**



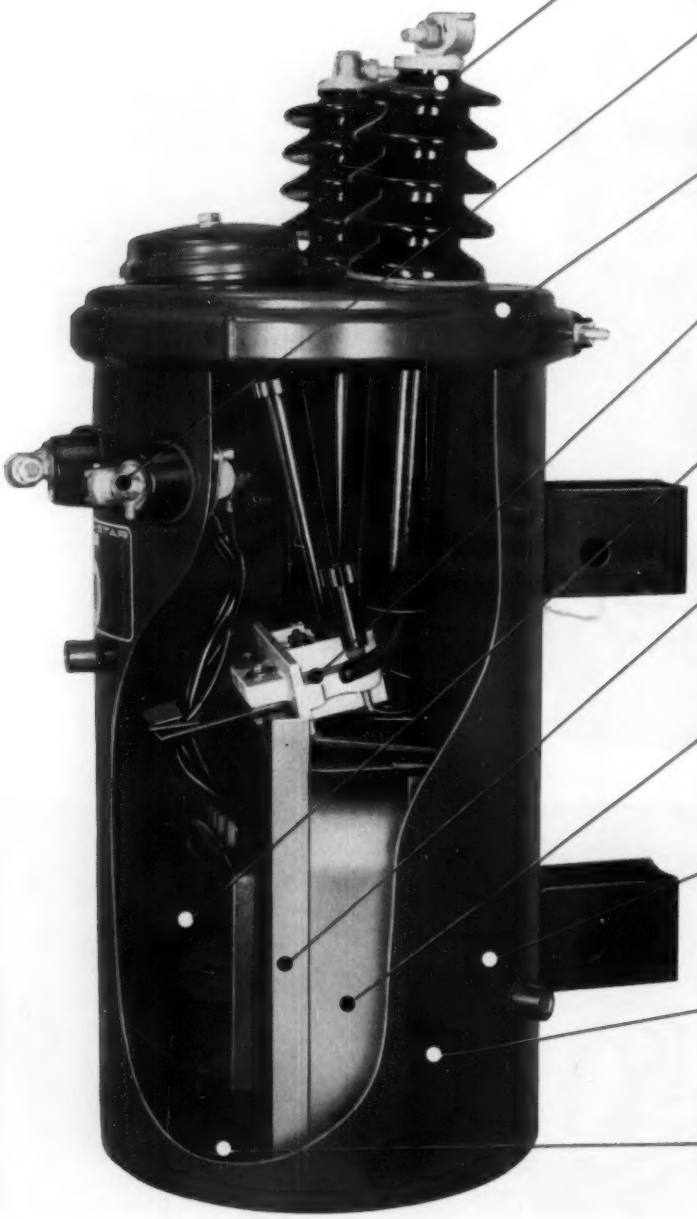
Impulse Test Area. Here Delta-Star engineers give impulse tests to each transformer produced. This is but one of the many additional tests which guarantee a product that meets the stringent requirements established by Delta-star.

Relentless production-line tests at Delta-Star measure ratio, impedance, excitation current and loss, polarity, insulation power factor, and corona. Applied and induced-potential dielectric tests further assure a quality product.

**H. K. PORTER COMPANY, INC.** DELTA-STAR ELECTRIC DIVISION

# SPECIAL FEATURES

. . . that help make Delta-Star Transformers small, light in weight, easy to maintain



## BUSHINGS

Designed to eliminate surge flashover inside tank. High-voltage bushings are corona-free at operating voltages. All porcelain is wet-process for high strength.

## TERMINALS

All of bronze alloys, tin-plated to receive either aluminum or copper conductors. All openings meet latest NEMA standards.

## COVER

One-piece non-corroding clamping band, re-usable nitrile rubber gaskets. Positive seal and natural shedding of water assured.

## TAP CHANGER

Handle grip above oil. Shorting bar under spring tension to assure positive positioning. Line leads brought to wet-process porcelain base for ease of servicing.

## COIL

Heavy Formvar wire wound on new Delta-Star winders. Liberal and balanced insulation. Ample ducts provide maximum cooling.

## CORE-COIL ASSEMBLY

Securely anchored to tank wall. Impossible to shift core or coil even under severest operating conditions.

## PORTER CORE

A wound core of grain-oriented cold-rolled silicon steel. Unique design results in low exciting current, smaller tank, minimum weight.

## TANK

Special design, in accordance with NEMA standards, minimizes number of external parts. Pressure-tested to assure perfect seal. Uniform design permits interchangeability between different kva sizes.

## FINISH

Provides maximum corrosion-protection. Special metal preparation prior to alkyd painting. All primer and finish coats baked.

## OIL

Inhibited oil supplied unless otherwise specified. Specially processed immediately before filling, to raise dielectric strength to maximum level.

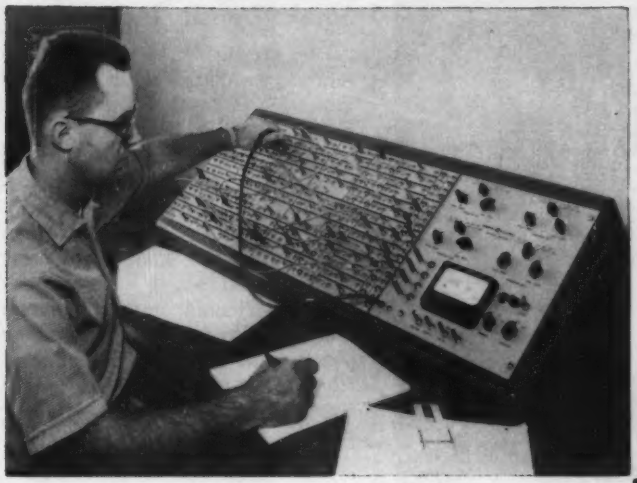
# H. K. PORTER COMPANY, INC.

## DELTA-STAR ELECTRIC DIVISION

Porter Divisions: Cleveland, Connors Steel, Delta-Star Electric, Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.

PRINTED IN U. S. A.

# NEW EQUIPMENT



## AC Network Analyzer . . .

**. . . simulates power transmission system** on a desk top, with patchcords. This miniature analog computer is designed for network problems too big for hand calculation but too small to justify use of a large analyzer.

It is particularly useful for load flow studies, capabilities analysis, analysis of transmission requirements to supply new loads, calculation of specifications for additions to existing networks, and short circuit and relay studies.

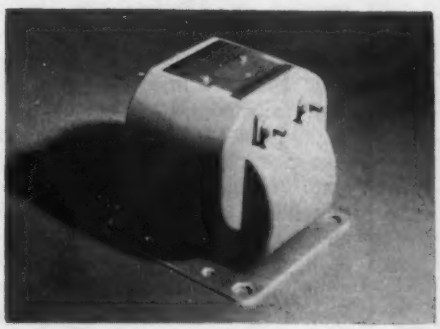
The device operates on 115 v, 300 w, is easy to maintain, and works under all normal temperature and humidity conditions.

**General Electric Co, Computer Dept, Phoenix, Ariz.**

## Three-Phase Bus . . .

**. . . is a non-segregated phase type,** air and porcelain insulated and completely sealed by cork-neoprene-gasketed split half-round covers. The 4.16-, 7.2-, and 13.8- kv; 1,200-3,000-amp buses are suited for generator leads to transformers, interconnecting switchgear assemblies and connecting them to transformers, and for power distribution in factories and office buildings.

**I-T-E Circuit Breaker Co, 19th & Hamilton Sts, Philadelphia 30, Pa.**



## Molded Potential Transformer...

**. . . for indoor or outdoor metering** has thermal capacity of 150 va and operates within 0.3 ASA accuracy class on single meters. The polyester-molded type EMP also handles multimeter installations with same accuracy if burden does not exceed 12.5 va at 10% pf. Voltage rating is 480-120 v, 60 cycles.

**Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.**

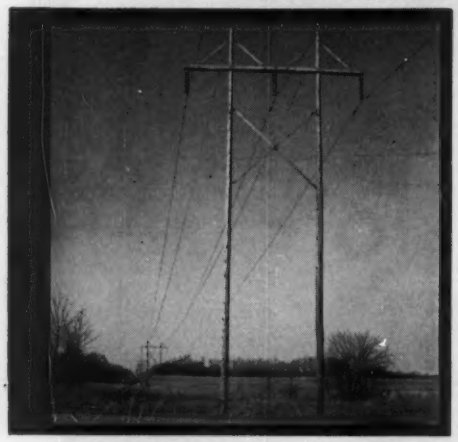
## Portable Heat Pump . . .

**. . . cools, heats, or dehumidifies** depending on its position. Placed in a window, the 60-lb unit draws heat from room and expels it outside. When turned around, warm air is pumped into the room. Set on the floor, it dehumidifies only. Operating on standard house current, the portable draws only 7.5 amp. Vinyl-coated aluminum cabinet, about the size of an overnight bag, adapts to window size with slide-in extenders.

**Carrier Corp, Syracuse 1, N. Y.**

(*More New Equipment on page* 118)

GALVANIZED STEEL STRAND



YOUR ASSURANCE OF HIGH QUALITY, LONG LIFE AND LOW COST

Close laboratory control over each step in manufacture has established Crapo Galvanized Steel Strand as a product of highest quality and dependability. You benefit through longer service life and lower ultimate costs.

Heavy, uniform, tightly-bonded coatings of commercially pure zinc, applied by the famous Crapo methods, withstand the punishment of construction, provide maximum resistance to corrosion and contribute to over-all economies.

For OVERHEAD GROUND WIRE . . .
CRAPO Weldless Galvanized Steel Strand

The most practical and economical strand for shielding transmission lines against lightning. Maximum strength and high fatigue endurance, inherent in Crapo Weldless Strand, provide that extra safety factor so important in overhead ground or static wire.

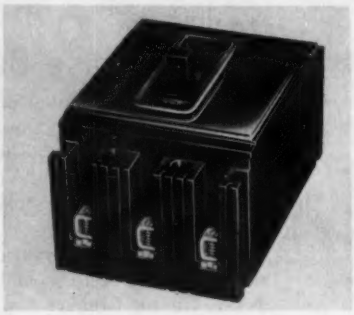
For GUYS and MESSENGER . . .
Crapo Galvanized Steel Strand. Made to highest standard specifications . . . a size and breaking strength to meet all practical needs.

Contact your jobber or write for descriptive folder.

INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana


## Smoke-Density Indicator . . .

**. . . for pressurized breechings** monitors smoke discharge and provides indication of combustion efficiency. Pressure sealing flanges seal sighting tubes on which light source and photoelectric scanner are mounted. Light source is installed on stack opposite scanner. Indicator measures density of smoke obscuring light beam, and shows it in %-smoke and Ringelmann number. Alarm relay can ring external alarm at any preset value of smoke density.
**Electronics Corp of America, 77 Broadway, Cambridge, Mass.**



## Molded-Case Breakers . . .

**. . . have higher capacity, are more compact** in AB line. A 3-pole breaker, type NEF (above) is designed especially for 480-v distribution. Mounted in an E-frame, its dimensions are $6\frac{1}{16}$ x $4\frac{1}{8}$ x $4\frac{3}{8}$ in. Ratings run 15-100 amp, and it can take short-circuit currents of 10,000 amp. A single-pole 120-v breaker, type NEW, comes in ratings of 15 and 20 amp with interrupting capacity of 5,000 amp, in cases only $1\frac{1}{16}$ in. thick.
**Federal Pacific Electric Co, 50 Paris St, Newark 1, N. J.**

## Polyphase Meter . . .

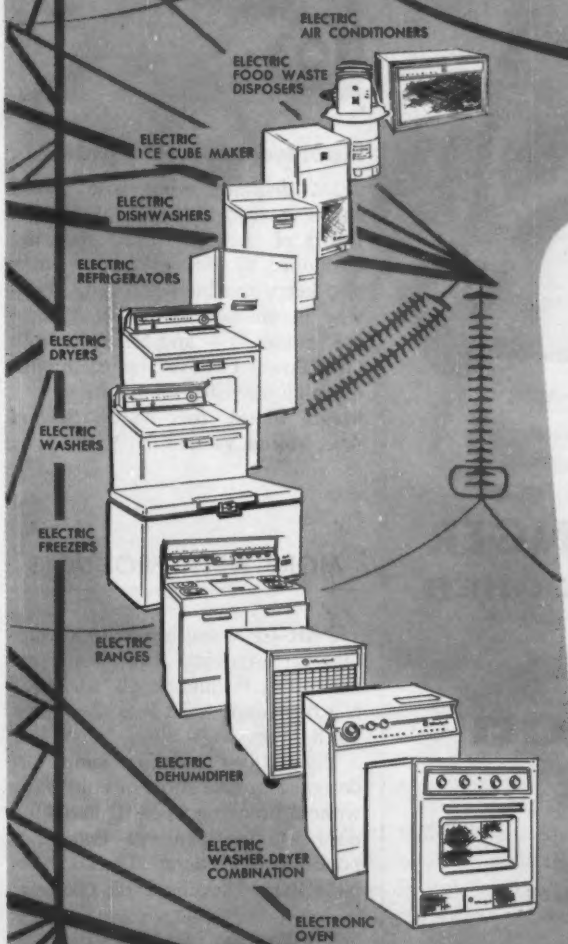
**. . . with extended range** up to 666.67% of rated current is designed for 3-wire, 2- or 3-phase circuits. Second of the V-60 family, the V-63 features magnetic suspension, butyl-molded current and potential coils, coordinated insulation, corrosion resistant material, surge-

(*Continued on page* 120)

# there's a hot NEW LOAD on your lines!

RCA Whirlpool

HOME APPLIANCES




Out of great laboratories where researchers and engineers look far into the future and create ideas such as the RCA WHIRLPOOL Miracle Kitchen, has come a new, complete line of major appliances that today are helping promote the electrical way of life.

All these appliances are keys to present and future expansion of utility revenue. They are helping to build a balanced load for electric utilities to provide tomorrow's electrical way of life.

Your local RCA WHIRLPOOL distributor or any one of our regional utility managers has full information on many successful electrical promotions. They are ready to work with you and are eager to serve you at any time. Write, wire, or call your local RCA WHIRLPOOL distributor for the complete and profitable load-building story.

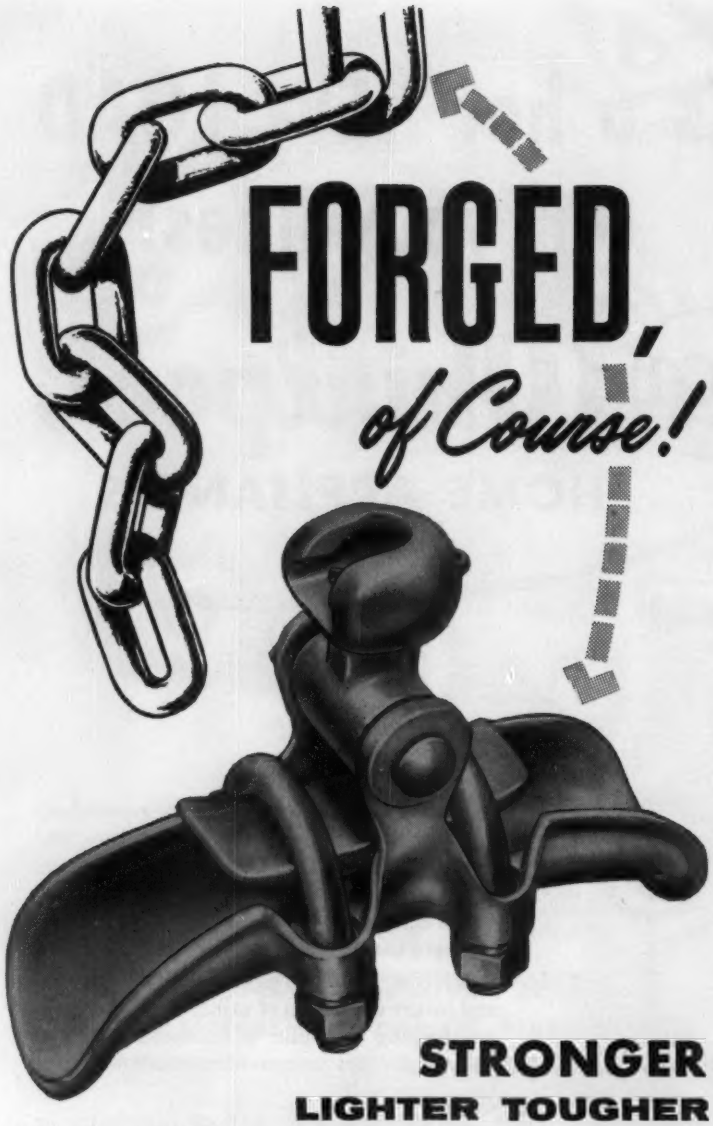
LIVE BETTER ELECTRICALLY

RCA WHIRLPOOL Home Appliances

Products of **WHIRLPOOL CORPORATION** St. Joseph, Michigan

***Creating opportunities for increased utility revenue!***

Use of trademarks ® and RCA authorized by trademark owner Radio Corporation of America




STRONGER
LIGHTER TOUGHER

BTC *Drop Forged*
**Suspension Clamps**

Long conductor life insurance
No excessive wear on connecting surfaces
No bore size allowance necessary
Wide range of sizes
Specify the best—BTC Hi-Line Hardware

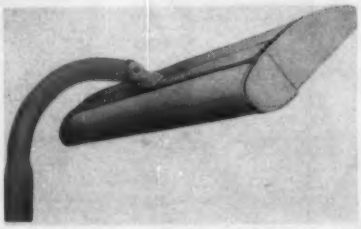
THE BREWER-TITCHENER CORPORATION
HI-LINE HARDWARE DIVISION • CORTLAND, N.Y.


## Polyphase Meter

(*Continued from page* 118)

current relief gap, and voltage compensation. Rated speed is 8⅓ rpm. Current coil has 60 amp-turns.

Used with new connection box, the V-63 can measure 200-amp loads without a current transformer. **General Electric Co, Schenectady 5, N. Y.**



## Fluorescent Area Lights . . .

**. . . dissipate wind with airfoil** shape extruded from aluminum. Doors of clear or ribbed glass are cushioned by neoprene gasket which also keeps out bugs and dirt. Wireway is weatherproof. The "Aerolite" comes in 4- and 6-ft sizes, with GE "Power Groove" lamps providing high-intensity illumination. **Magni Flood, Inc, 38 N. Second Ave, Mount Vernon, N. Y.**

## *MORE NEW PRODUCTS*

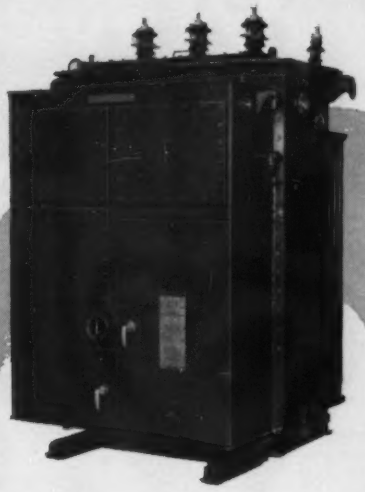
PAR-46 **sealed-beam floodlamps** for earth-moving equipment are made to withstand shock. No. 4078 is a 6-v lamp; 4478 is a 12-v lamp; 4578 takes 24 v.

Five 400-w **mercury lamps** are designed to take snow or cold water without breaking when lighted. Outdoor use in open-type fixtures is possible. — General Electric Co, Nela Park, Cleveland 12, Ohio.

**Oscillograph** features cartridge loaded record magazine, records 18 channels on 12-in. wide recording paper.—Hathaway Instrument Div, Hamilton Watch Co, 5800 E. Jewell Ave, Denver 22, Colo.

(*More New Products on page* 124)

# 16 ADVANTAGES OF 16-STEP OPERATION NOW AVAILABLE ON 3-PHASE URS STATION-TYPE REGULATORS



*In addition to the advantages of 16-step operation, URS regulators provide long, trouble-free life through • MAGAMP—completely static control • 20-year warranted contacts • Separate oil compartment for tap changer • Shock-free, direct drive Geneva gear mechanism prevents loosening parts • Concentric lead or six bushing construction optional.*

A new selector switch, mounted on the panel of 3-phase URS regulators, permits selection of ⅝% step operation; or 1¼% step operation, where out-of-step or similar paralleling with ⅝% step is not required. Similar units may be paralleled on 1¼% steps.

Selection of 1¼% step regulation, by forcing two-step operation of the high speed response mechanism on the URS regulator, *provides benefits of 1¼% step regulation* — holds closer to set balance voltage.

The selector will be furnished on any new 3-phase URS regulator, without charge, if specified on the order.

Conversion of your present URS regulators for 16-step operation can be achieved at small cost.

For further information, contact your Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

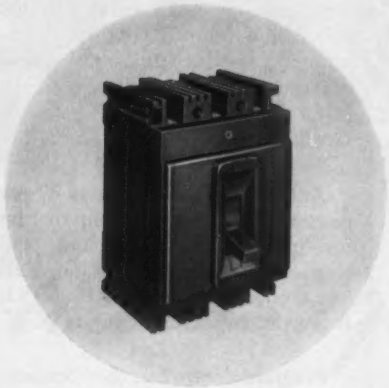
J-70826

YOU CAN BE SURE...IF IT'S Westinghouse

# FEDERAL PACIFIC LAUNCHES

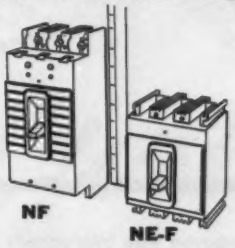
# Industry's Biggest AB Breaker Development Program

Here they are—the first two important new developments in Federal Pacific's sweeping AB Circuit Breaker research program. Designed to give you more wiring space, greater economy and flexibility than you've ever had before—these two new devices are indicative of the kind of "forward thinking" Federal Pacific is applying to its entire AB breaker line.

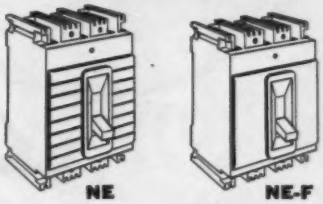


## SPACE SAVING 480 V "NE-F" BREAKER

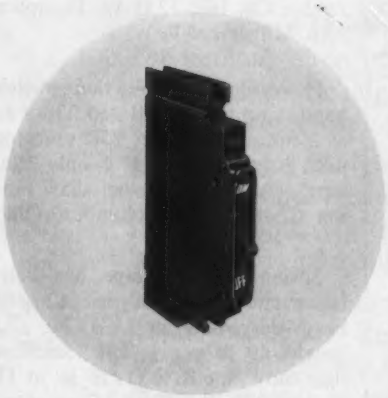
This compact new breaker, specifically designed to meet a growing demand for 480 v rating—eliminates waste space. ⅓ smaller than regular "NF" breakers—the new 480 v "NE-F" actually *costs less than present size "NF" breakers!* Available in ratings from 15 through 100 amps.




**1/3 SMALLER!** New "NE-F" as compared with standard "NF" Breaker.

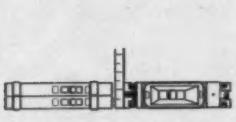



**DESIGN FLEXIBILITY!** Interchangeable with regular "NE" breakers.

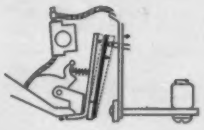


## SPACE SAVING 11/16" WIDE SINGLE-POLE "NE-W" BREAKER

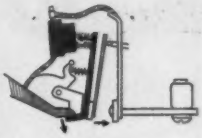
Just half the width of conventional single-pole "NE" breakers, this new device lets you get twice the number of circuits in the same space formerly required. Cost? Considerably less than ordinary single-pole "NE" breakers. Ratings: 15 and 20 amps. One 11/16" breaker is 120/240 V A-C, and the other 11/16" breaker is 277 V A-C. Both equipped with coil magnetic trip and ambient compensation.



**HALF THE SIZE OF ORDINARY "NE's"**—Compact design retains all proved features of AB breakers.



**AMBIENT COMPENSATION**—Separate bimetal eliminates derating due to high ambients.



**COIL MAGNETIC TRIP**—Magnetic coil trips breaker instantly...assures positive protection.

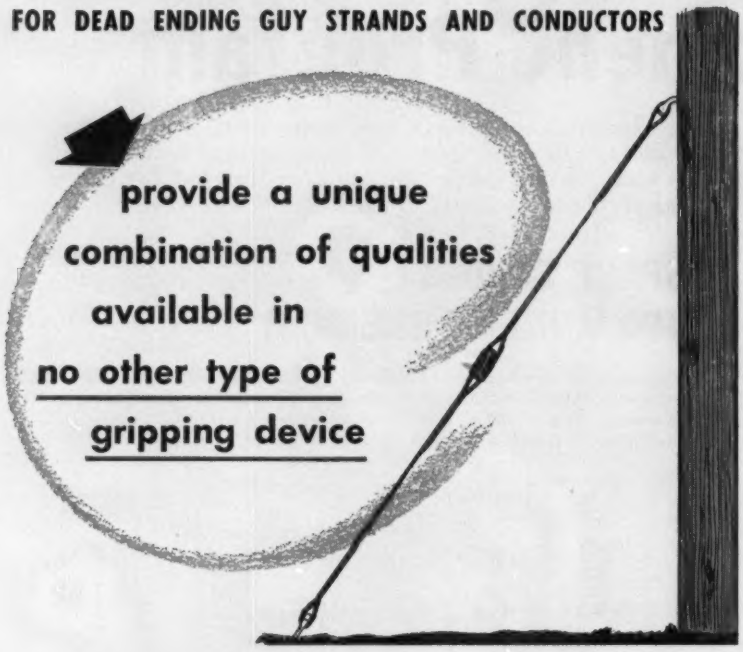
But this is only the beginning! There's more to come! You'll find a steady stream of new breakers and new features being added to the Federal Pacific's line to give you the most complete, most-up-to-date AB breaker line available. For full information write: Federal Pacific Electric Company, 50 Paris Street, Newark 1, N. J.

FEDERAL FPE PACIFIC

Better Products to Control Electricity

# FANNER FANNGRIPS

**FOR DEAD ENDING GUY STRANDS AND CONDUCTORS**

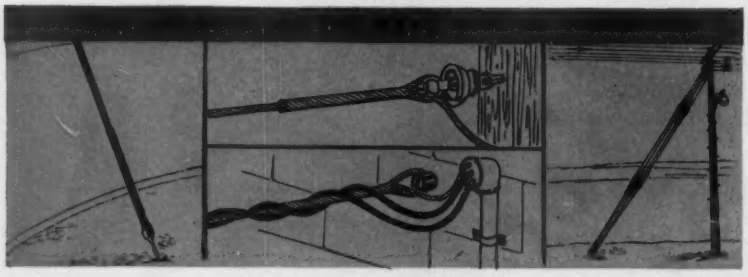



FANNGRIPS are made of highest grade spring-type wire by Fanner's exclusive roll-forming process. They provide a permanent and positive grip, and, because the frictional force is greater than the strand strength, FANNGRIPS cannot slip!

- Provide maximum load strengths — eliminate variables in application.
- Apply in a minimum of time — eliminate laborious field fabrication.
- Permanently tight, self-clamping — no movement or relaxation due to load reversal.
- Corrosion resisting.
- May be removed and reapplied when necessary.
- Do not damage surface of strands.
- Neat application without bulk — no dangerous or wasteful ends.
- Available in electro galvanized steel, copperweld or aluminum alloy.

***No other dead-ending method matches FANNGRIPS economy!***

**WRITE FOR CATALOG**



Licensed for use under patent Nos. 2,275,019 and 2,587,521

**THE FANNER MANUFACTURING COMPANY**

Electrical Products Division

BROOKSIDE PARK • *Established 1894* • CLEVELAND 9, OHIO

Telephone: SHadyside 1-6000

Fine Fanner Superformed

AGENTS and DISTRIBUTORS IN PRINCIPAL CITIES

ARMOR RODS • LINEGUARDS • TAP ARMOR
PATCH RODS • FANNGRIPS • PLASTIC FANNGUARDS
PLASTIC INSULATING TUBINGS AND MOLDINGS


Dual-action **electric drill** gives impact plus regular action, has drilled ½-in. hole through three in. of concrete in under 30 sec. Speed: 1,700 rpm under load.—Power Tools Corp, 1421 Lakeside Ave, Cleveland 14, Ohio

Redesigned **push-button stations** for heavy-duty applications are rated 600 v ac or dc. They have from one to five speed points, up to eight circuits.—Euclid Electric & Mfg Co, Madison, Ohio

Two-speed, fast-approach, **hydraulic power pump** works at 6,000 psi, can develop 10,000-psi intermittent pressure. It handles conduit benders, hydraulic rams, or jacks faster than a hand pump.—Greenlee Tool Co, Rockford, Ill.

**Automatic dynamometers** check electric motors from 0.02 hp to 1 hp for free-running, load, and stall characteristics.—Magtrol, Inc, College and Highland Ave, Box 193, Bridge Station, Niagara Falls, N. Y.

**Program controller,** the "Sequentrol", provides automatic sequencing for shaft-mounted gear motors from subfractional to 10 hp.—The Jordan Co, Inc, 3235 W. Hampton Ave, Milwaukee 9, Wis.

Heavy-duty, **snap-action switch** handles up to 2 hp. Rated 230 v ac at 2 hp and 20 amp, 250 v ac for pilot duty, "Duo-Snap" is only 2 in. long.—Acro Div, Robertshaw-Fulton Controls Co, Columbus, Ohio

Spring-steel **fish tape** has ball-roller end and handgrip. Largest heavy-duty tape is 1x⅛ in. and weighs 49 lb per 100 ft. Smallest light-duty tape is ¼x1/16 in. at 11 lb per 100 ft.—T. J. Cope Div, Rome Cable Corp, Collegeville, Pa.

Mobile **two-way radio** uses transistors for full-power conversion from 12-v battery voltage to transmitter and receiver high voltage. "Heat sinks" allow high temperature operation.—Motorola, Inc, Communications and Industrial Electronics Div, 4501 W. Augusta Blvd, Chicago 51, Ill.

(*More New Products on page* 129)

# "You're right, Walters," said the V-P...

"Yes," mused the V-P in Charge of Engineering to his luncheon companion, "from the information I get, Walters, I've also concluded that we ought to push for an early start on the new plant,—keep clear of those short-capacity situations."

He had been studying young Walters carefully since their conversation had settled on the subject of the Company's future. "You're right, Walters, but where did you get your data? Most of the material available to me——"

"——isn't available to me," Walters finished for him, smiling. "That's true, Mr. Redmond, **most** of it isn't. But I can read the Electrical Business Outlook page of Electrical World and their other forecasts as well as you can—and I do!"

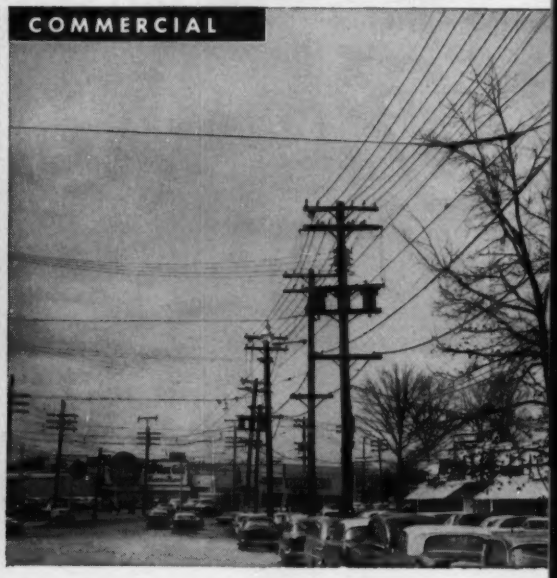
**"Of course,"** replied Redmond, looking a little sheepish. "Why do I always assume that that particular page is written only for me?"

"Oh, everybody does the same thing," answered Walters. "I get the same feeling about articles in my own field—that they're written for me particularly. But I read practically everything in that magazine every week, whether it's in my area or not,—you'd be surprised how much useful information I pick up."

"You've got to get up earlier than that to surprise **me,**" laughed Mr. Redmond, reaching for the check. "I was doing exactly that when you were in three-cornered pants!"

# GEORGIA POWER

## builds load by



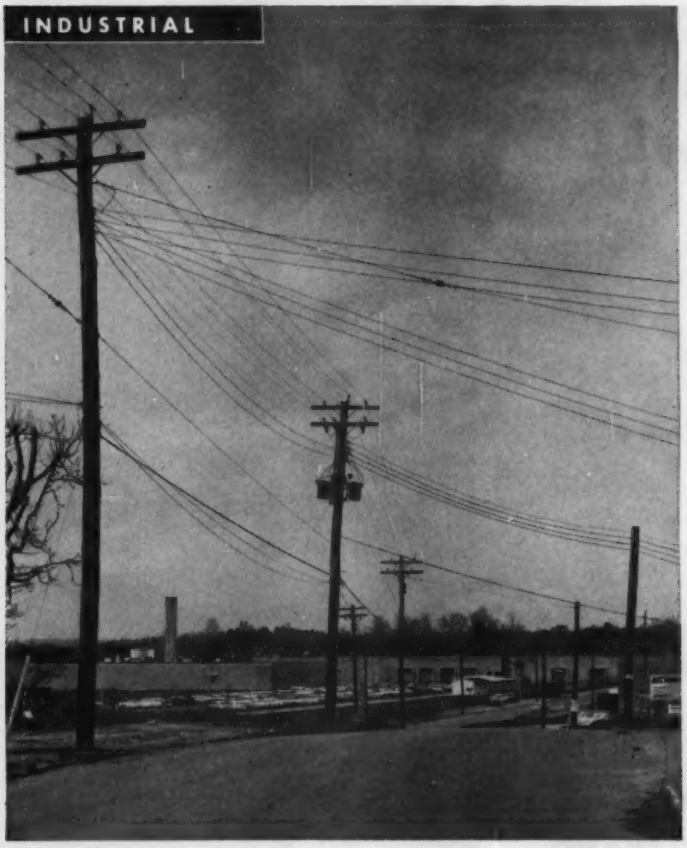
## To keep up with Georgia's growth, Company buys over 30,000 pressure-creosoted poles a year

Georgia Power Company purchases in excess of 30,000 pressure-creosoted poles per year to extend its 18,024 miles of present distribution lines. The system is 100% pressure-creosoted; there are more than 430,000 pressure-creosoted poles in service.

In industrial areas, these pressure-creosoted poles not only carry the lines themselves, but the street lighting fixtures and heavy-duty transformers as well. Pressure-creosoted poles give between 20 and 25 years of life.

# COMPANY

## attracting new industry to state




THE POST-WAR YEARS have brought Georgia more large manufacturing plants than any other state in the Southeast, and the fourth largest number in the entire nation. Georgia Power Company has been doing its part in encouraging these companies to locate in its area.

Georgia Power offers a full consulting service to industry planning to locate there. The company also runs advertisements in national publications and distributes brochures that dramatize the natural resources, labor advantages and, not least of all, the inexpensive, dependable power the company offers to industrial newcomers. One of the major features stressed, in addition to low-cost power, is the low cost of construction.

Since the end of World War II, 3,300 concerns have established manufacturing plants in Georgia. To keep pace with this phenomenal growth, sales of industrial electricity have increased from 1,723,664,355 KWH in 1949 to 2,878,895,477 in 1955. The residential and commercial uses of electric power have increased proportionately to the industrial usage.

If you would like more information on pressure-creosoted utility poles, and the way they can enable you to save money and establish better service for your utility, just get in touch with the nearest Chemical Sales Office of United States Steel or write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

UNITED STATES STEEL USS CREOSOTE

***CREOSOTE'S PAST ASSURES WOOD'S FUTURE***

# USS CREOSOTE

*Sales Offices in* Pittsburgh, New York, Chicago, Cleveland, Salt Lake City, and Fairfield, Alabama

UNITED STATES STEEL

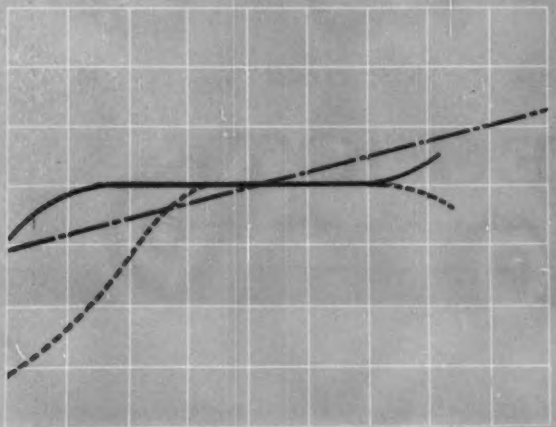
# The "performance charts" are built-in...

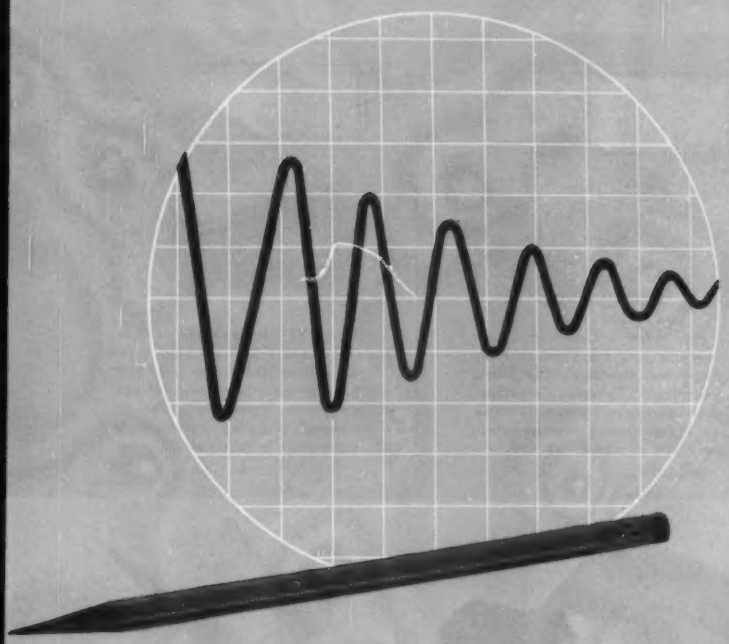
The real value of a capacitor lies, of course, on the inside, and this is where C-D puts its manufacturing dollars. The results, as you would expect, are longer life expectancy, the ultimate in dependability, and the ability to carry the load.

C-D built-in extras are always on the inside where they never lose their "newness" — extra safety, extra reliability, extra long life . . . internal extras that keep paying off year after year.

That is why C-D capacitors give you so much more than a paper "one-year" guarantee. This is why C-D capacitors are "Best by Field Test."

Insure low-maintenance service from your next power-factor capacitor installation, by talking it over first with a C-D engineer. Just write Cornell-Dubilier Electric Corporation, Dept. D-107 South Plainfield, New Jersey.





**Here's why C-D Capacitors consistently exceed all field performance requirements:**

• Lowest dielectric unit stress and highest major insulation level. • Dykanol-filled bushings increase accepted flashover safety-factor, insure high level of impulse withstand. • Removable solderless connectors. • Many sections in series-parallel connection. Extremely low voltage gradient per section; less heating; no corona; longer life; lower power-factor. • Discharge resistor connected to each series section, instead of terminal to terminal. Provides effective discharge for each series group and balanced voltage distribution. • Side mounted lifting lugs—stronger and avoid risk of flashover. • Energization tested, 100 percent, to assure uniform distribution of low dielectric losses.

# CORNELL-DUBILIER

consistently dependable

## power-factor capacitors

SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER & CAMBRIDGE, MASS.; PROVIDENCE & HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD, FUQUAY SPRINGS & VARINA, N. C.; VENICE, CALIF.; & SUB.: THE RADIART CORP., CLEVELAND, OHIO; CORNELL-DUBILIER ELECTRIC INTERNATIONAL, N. Y.

Four **1,000-w mercury lamps** have phosphor coating which converts ultra-violet into white light. They provide nearly 5% more light than previous lamps.—General Electric Co, Nela Park, Cleveland 12, Ohio

**Heat pump** is rated up to 11,400 Btu per hr heating, 4,800 Btu per hr cooling, at 175 cfm. It circulates water at 2 gpm.—Percojet Electric Heating and Cooling, Inc, 890-898 Broadway, Newark 4, N. J.

**Metallic tubing** offers high corrosion resistance and strength. "Yoloy" steel tubing is designed for rough usage, longer life with less pitting and weight loss. — Youngstown Sheet & Tube Co, Youngstown 1. Ohio

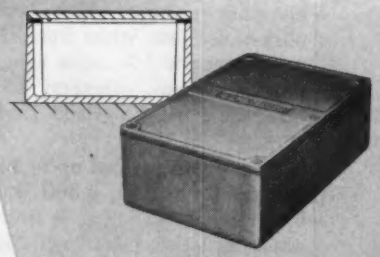
Photoelectric **light control** for highways, airports, industrial areas, signs, provides automatic on-off control of outdoor lighting systems. Reacting to daylight intensity, it is unaffected by seasonal changes.—Photoswitch Div, Electronics Corp of America, Cambridge 42, Mass.

For general purpose wiring, type RHH **wires** with silicone rubber insulation and asbestos braid are available in sizes 14 through 6 Awg.—General Electric Co, Construction Materials Div, Bridgeport 2, Conn.

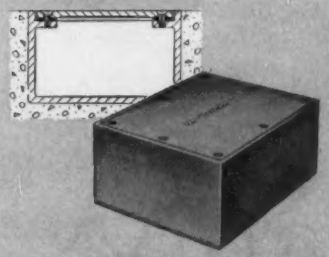
**Sub-feed lug kit** allows addition of sub-feeds to standard NQO circuit breaker lighting panelboards in 100 amp and 200 amp ratings.—Square D Co, 6060 Rivard St, Detroit 11, Mich.

**Fluorescent mine-lighting** systems cannot explode or cause fires. Each unit contains two lamps, weighs only 12 lb. Operating voltage of 230 v ac permits cool operation with long lengths of cable.—Femco, Inc, Irwin, Pa.

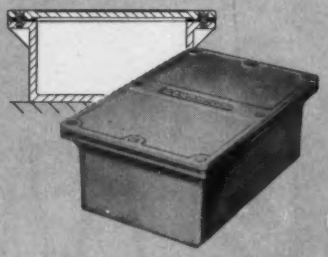
**Paralleling reactor** equalizes current distribution to rectifiers, variable transformers, adjustable reactors, and rheostats. The PR 1600 is rated at 1,600 amp rms for 50C temperature rise with normal convection cooling, and is protected against moisture and corrosion.—International Rectifier Corp, 1521 E. Grand Ave, El Segundo, Cal.



Type "YS" This unit is unflanged for surface mounting, and it is Dust-Tight and Weatherproof. The simplest in design of all the Cast Iron Boxes in the broad O.Z. line, the Type "YS" is also the most popular and the most widely used. UL approved. 133 sizes.



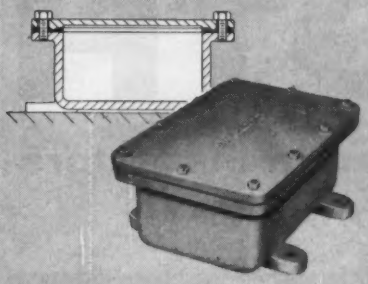
Type "YU" A Recessed Cover Junction Box, the Type "YU" is designed especially for flush mounting in masonry. Weatherproof and Dust-Tight, the box has an inside flange and recessed cover. UL approved. 43 sizes.



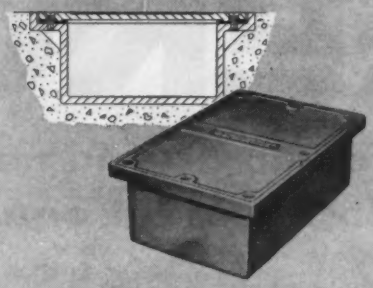
Type "YF" UL approved as Raintight, the "YF" is Watertight and submersible under a 20 foot head of water. Designed for outdoor use, this unit is recommended wherever a watertight installation is required. 78 sizes.

**O.Z. means more for you**

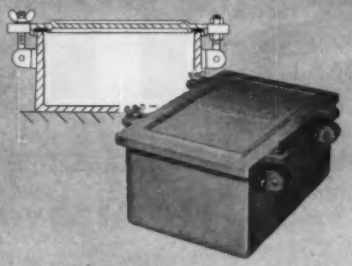
- CAST IRON BOXES
- CABLE TERMINATORS
- POWER CONNECTORS
- SOLDERLESS CONNECTORS
- GROUNDING DEVICES
- CONDUIT FITTINGS
- INTERLOCKED ARMOR CABLE FITTINGS



**Type "YH"** This is a heavy duty box, with extra-thick walls. It is listed by the Underwriters' Laboratories, Inc., as Raintight. Type "YH" boxes are submersible under a 50 foot head of water. 80 sizes.



**Type "YR"** An outside flanged recessed cover box, approved by the Underwriters' Laboratories, Inc., as Raintight, the Type "YR" is designed for flush mounting in walls or floors. 45 sizes.

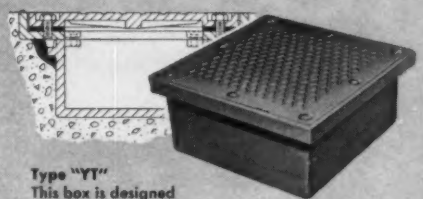


**Type "YW"** A hinged cover box, the Type "YW" makes an ideal enclosure where equipment within the box must be inspected frequently and easy access is required. This unit has been approved as Raintight by Underwriters' Laboratories, Inc. 110 sizes.

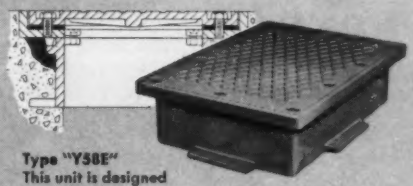
# O.Z. gives you 10 types–678 sizes to choose from!

**O. Z. Junction Boxes are built in such a wide, wide range of types and sizes that they meet almost unlimited *standard* requirements! In addition, all O. Z. Junction Boxes can be supplied with modifications that meet *your* specific applications exactly. Materials, conduit entrances, and mounting lug locations all may be varied. Yet, no matter how you order, O. Z. Junction Boxes embody—in design, in detail, in materials, in workmanship—the high standards of quality characteristic of *all* O. Z. products. Next time you need junction boxes, take advantage of the largest selection available in the industry! Make O. Z. your first choice ...It's your biggest choice!**

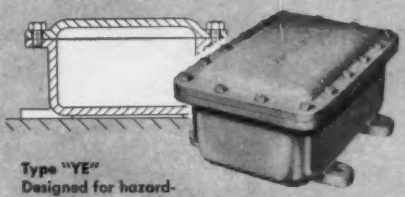
Call your local O. Z. distributor, or write direct to the company for complete information.



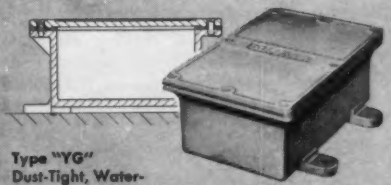
**Type "YT"**
This box is designed to be mounted in sidewalks and other flat concrete surfaces. The checkered cover has reenforcing ribs and is made to withstand pedestrian and light vehicular traffic. 33 sizes.



**Type "Y38E"**
This unit is designed to top off an underlying concrete pull box. The flange and cover can be replaced without disturbing the box the same as the Type "YT". 5 sizes.



**Type "YE"**
Designed for hazardous locations, Class I, Group D. Type "YE" boxes are Explosion-Proof, Dust-Tight, and Weatherproof. All joints are of the metal to metal type, ground to exceptionally close tolerances. 80 sizes.



**Type "YG"**
Dust-Tight, Watertight. For hazardous locations, Class II, Groups E, F, and G, covering atmospheres containing metal dust, carbon black, coal or coke dust, and grain dust. 76 sizes.

O.Z. ELECTRICAL MANUFACTURING CO., INC.

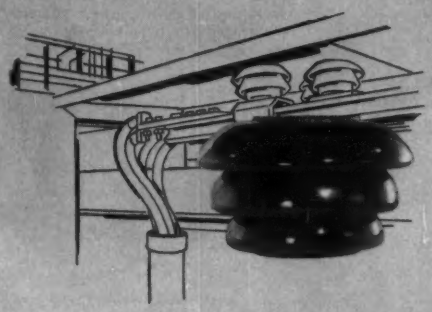
262 BOND STREET • BROOKLYN 17, N. Y.

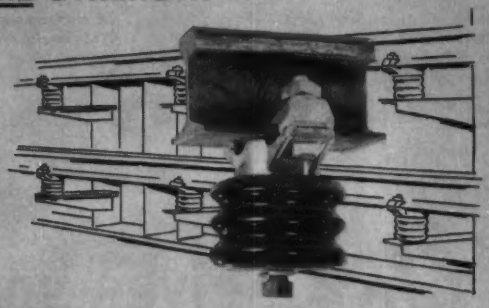
Sales Office and Warehouse: 406 So. Cicero Avenue, Chicago 44, Ill. • ESterbrook 9-0326
Office and Factory: 749 Bryant Street, San Francisco 7, Calif. • GArfield 1-7846

# STRENGTH

## Which kind of strength do you need in insulators for traveling-contact equipment?

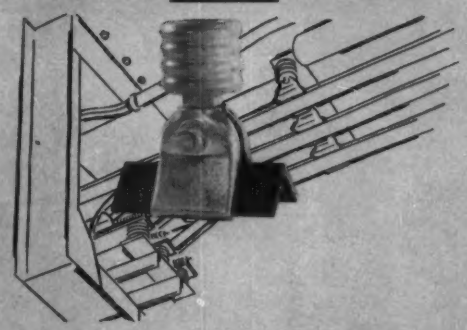
### MAXIMUM ELECTRICAL STRENGTH





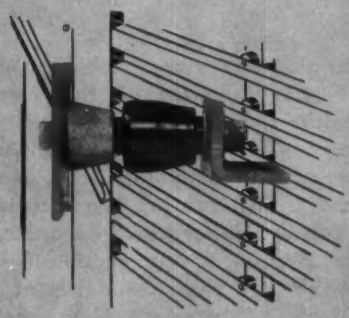
Wet-process porcelain insulators, such as these, offer outstanding electrical properties for high-voltage contact-rail insulation. Especially recommended where dirt, moisture, and other contaminants prevail.
Also available are dry-process porcelain units for power circuits.

### MAXIMUM IMPACT STRENGTH



Molded polyester-fiberglass insulators and fabric-reinforced insulators of this general type have exceptional impact strength and vibration-resistance combined with good electrical properties. Tailored to resist chemicals, thermal shock, weathering.

### MAXIMUM TENSILE STRENGTH



Molded Giant Strain insulators, adaptable to miniaturization where space is restricted, offer unusual mechanical strength. A very economical insulator having diverse applications.

## TO HELP YOU DECIDE . . .

. . . on the right combination of properties to meet your insulator needs, Delta-Star engineers from coast to coast invite your problems. Phone the nearest Delta-Star district office or write to Electric Service Works, Delta-Star Electric Division, H. K. Porter Company, Inc., 17th & Cambria Sts., Philadelphia 32, Pa.

# H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Porter Divisions: Cleveland, Connors Steel, Delta-Star Electric, Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.

# ELECTRICAL BUSINESS OUTLOOK

**Electrical World**
OCTOBER 14, 1957

**Let's take a look at prospects for industrial load in the Sixties.** With capital expenditures leveling off next year, defense cuts dampening spirits in some industries, and a stock market that has been losing ground since mid-summer, some of the optimistic forecasts of the industrial climate of 1965 may seem a little like whistling in the dark.

**Since 1948 U. S. industrial consumption of electricity has doubled.** But after all, the years between 1948 and the present were stimulated by two postwar booms, more than par for the course. Does it follow that industrial consumption will double again by 1970, as predicted?

**Research is one big reason for this optimism.** It did not contribute significantly to the postwar booms. More money has been poured into research and development since 1950 than in all the years before. And the sharpest rises didn't come until '55 and '56, after tax revision made R&D expense deductable.

**We haven't begun to see the effects of this rise yet** in terms of selling new products—much less in terms of building the capacity to produce them.

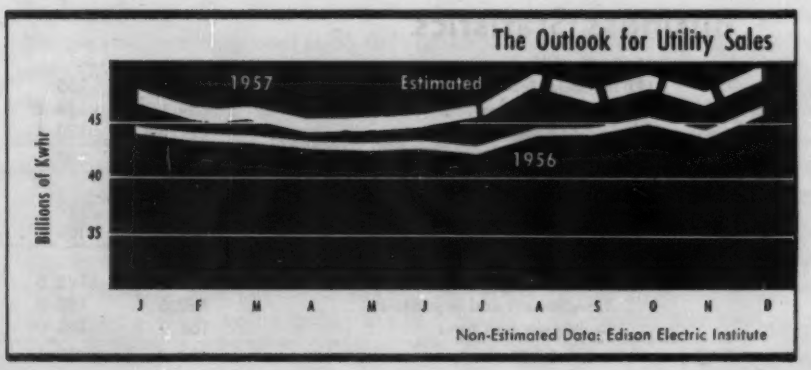
**Reason for this is a 7- to 10-year lag between lab and market place.** It takes that long to iron out enough wrinkles to offer a new product for sale.

**We won't see much in 1958 either.** The products that have been under development since '55 still won't have hit the market. Even after they do, it will be a while before manufacturers order the machinery to turn them out in quantity.

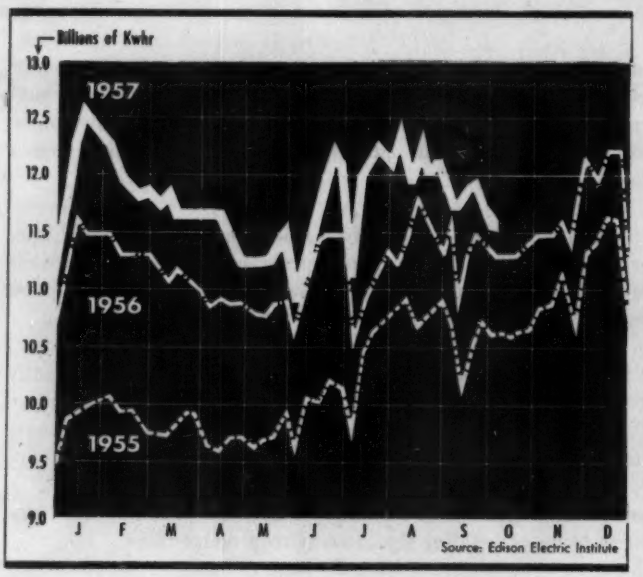
**By 1960 industrial capacity for producing new products will have started up.** According to the McGraw-Hill Department of Economics, capital expenditures for new products should account for about 17% of manufacturers' capital outlays by then—as against 6% in 1956.

**But the real payoff won't come until the mid-Sixties.** Then the consumer goods industries will have to start tooling up for mass output of their really new products—the turbine-powered autos, all-plastic houses, and paper wearing apparel that are under development right now.

**And then will begin the greatest capital goods boom in history,** with an attendant climb in the demand for industrial power. The seeds for it are in the ground —and there's no good reason why they won't come up.



# STATISTICS




## OUTPUT

**Week ended October 5, 11,564,000,000 Kwhr Up 2.0%**

Per Cent Change From Previous Year

| | Sept. 21 | Sept. 28 | Oct. 5 |
|---|---|---|---|
| Total U. S. | +4.4 | +2.9 | +2.0 |
| New Eng. | +6.3 | +4.1 | +3.6 |
| Mid. Atlan. | +7.9 | +3.3 | +1.1 |
| Cent. Ind. | +2.9 | +1.7 | +0.8 |
| West Cent. | +2.5 | +2.5 | +3.3 |
| Southeast | +5.7 | +5.0 | +4.3 |
| South Cent. | +0.5 | −1.2 | −3.2 |
| Rocky Mount. | +2.4 | +0.9 | +2.1 |
| Pacific | | | |
| NW | +4.3 | +1.6 | +1.0 |
| SW | +5.7 | +6.7 | +5.4 |

Seasonally Adjusted Index 222.3
Week Ago 224.6
Year Ago 218.2

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 2.9%.

## Power Statistics . . .

| | | Latest Month | Preceding Month | Year Ago | Annual Change % |
|---|---|---|---|---|---|
| Capacity | July | 124.99 | 124.43 | 117.54 | 6.3 |
| Peak—Class 1 Systems (million kw) | May | 97.8 | 97.7 | 92.8 | 5.4 |
| Estimated Dec. '57 Peak (million kw) | July | 113.2 | 113.6 | 114.4 | −1.0 |
| Production—billion kwhr | July | 54.35 | 52.05 | 49.45 | 9.9 |
| Hydro | | 10.81 | 11.18 | 9.91 | 9.1 |
| Fuel | | 43.54 | 40.87 | 39.54 | 10.1 |
| Sales—billion kwhr | June | 46.99 | 46.00 | 44.46 | 5.7 |
| Residential | | 11.91 | 11.86 | 11.02 | 8.1 |
| Commercial | | 7.90 | 7.38 | 7.29 | 8.4 |
| Industrial | | 24.64 | 24.89 | 23.72 | 3.9 |
| Other | | 2.54 | 2.48 | 2.42 | 5.0 |
| Fuel Consumption | July | | | | |
| Coal—million tons | | 12.72 | 12.50 | 12.00 | 6.0 |
| Oil—million barrels | | 5.51 | 6.24 | 4.32 | 27.5 |
| Gas—billion cu ft | | 158.91 | 125.72 | 136.97 | 16.0 |
| Net Income Class A & B Co's $—million | July | 100.92 | 109.69 | 96.19 | 4.9 |
| Residential Customers—millions | 12 mos | 46.35 | 46.26 | 45.09 | 2.8 |
| Revenue per kwhr | ended | 2.58¢ | 2.58¢ | 2.61¢ | −1.1 |
| Avg kwhr per customer | July 31 | 3,082 | 3,063 | 2,900 | 6.3 |
| Avg annual bill | | $79.52 | $79.03 | $75.69 | 5.1 |

## Business Statistics . . .

| | | | | | |
|---|---|---|---|---|---|
| Indexes: 1947–49 = 100 | | | | | |
| FRB Industrial Production | Aug. | 144 | 135 | 142 | 1.4 |
| ENR Construction Cost | Sept. | 154.7 | 154.8 | 147.8 | 4.7 |
| BLS Cost-of-living | Aug. | 121.0 | 120.8 | 116.8 | 3.6 |
| New Orders for Machinery (1950 = 100) | Aug. | 134 | 147 | 142 | −5.6 |
| NEMA Sales | | | | | |
| Insulation materials | Aug. | 134 | 127 | 153 | −12.4 |
| Electric appliances | | 86 | 101 | 100 | −14.0 |
| Wholesale prices | Aug. | | | | |
| Motors and generators | | 142.5 | 142.5 | 133.3 | 6.9 |
| Transformers and regulators | | 150.6 | 150.6 | 139.7 | 7.8 |
| Switchgear and fuses | | 166.9 | 166.9 | 153.8 | 8.5 |
| GNP—annual rate—$ billion | 2nd qtr. | 434.4 | 429.1 | 410.8 | 5.7 |

# MANAGEMENT BULLETIN

## FINANCE

**Give the investor more of what he wants**—namely appreciation potential, Basil B. Elmer Jr, assistant vice-president, First Boston Corp, told a conference of state public service commissioners recently.

**The most important item in appreciation potential,** he said, is prospective improvement in per-share earnings. Regardless of the amount of growth in the territory, a company's per-share earnings will not materially improve unless at least one of four things happen:

**1. Unless the cost of capital,** excluding common equity capital, declines. **2.** Unless the capital structure is changed to produce greater leverage on the common stock. **3.** Unless the overall rate of return on invested capital improves. **Or, 4,** unless there is a significant reinvestment of retained earnings at an adequate rate of return.

• • •

**It may be here's a way to save time and money on your next financing deal.** Commonwealth Services, Inc, which assisted Consumers on its $35 million bond issue sale recently, arranged for The Service Bureau Corp, a subsidiary of International Business Machines Corp, to compute the special redemption prices in less than two minutes on the IBM 650 Data Processing Machine. Normally, Commonwealth says, calculations with special redemption features required several man hours. The machine performed the task in 1.2 minutes.

**Every hour saved in calculating redemption prices,** Commonwealth points out, is especially valuable to the underwriter because the special redemption prices are printed in the prospectus which must be made available to the purchaser at the time the bonds are offered for resale. Computing the prices electronically facilitates earlier SEC registration and marketing.

## REGULATION

**Iowa Supreme Court rules in favor of fair value.** Court upholds the Iowa-Illinois Gas & Electric Co against the City of Fort Dodge in a gas rate proceeding in which the city's contention for an original cost rate base was upheld in favor of fair value in which a heavy weighing was given to reproduction costs.

**This requires cities to consider reproduction cost** as well as original cost. Supreme Court held that the proportions should be 70% for reproduction costs depreciated and 30% for original cost depreciated, thus increasing the company's rate base.

**A 6% rate of return on this fair value rate base** was affirmed by the court. It held that the company's return of 3.93% which resulted from the city's ordinance rates was confiscatory and therefore unconstitutional.

**Fair value was also declared to be the basis for determining annual depreciation expense.** District Court had held that depreciation should be figured on the original cost of the property.

**Supreme Court affirmed the District Court's determination** that the sale of gas to the electric generating station be the regular interruptible rate and not at the company's cost of gas alone.

**Temporary injunction of the District Court** extended for 16 months during which the company charged rates subject to refund. District Court found that the company should refund $128,154. Supreme Court reduced this to $118,226 after applying its modifications of the fair value rate base and the depreciation expense found by the District Court.

**City's interpretation of the Hope Case** as authorizing the "end result" theory was held not to be applicable in Iowa. ("End result" theory is, in effect, that if the company earns enough money to pay expenses, bond interest, and dividends, it makes no difference what the value of its property may be.)

**Supreme Court held that the Iowa courts have no power to fix rates,** but only to determine when the rates are unconstitutional.

**Finally, the Supreme Court made this observation** that property rights are also human rights and that "Freedom is invaded when property rights are ignored and this is true when the property confiscated is owned by stockholders through a corporation as well as when it is an individual's home, his livestock, or the tools by which he earns his living."

## TAXATION

**Protest of 13 cities and towns against the assessment of taxes** against their municipally owned electric utilities was rejected recently by Wyoming's State Board of Equalization.

**In its ruling,** the board held the cities and towns were operating their power systems as a business enterprise primarily to raise municipal revenue, and not as governmental functions.

**This was in line with two opinions on the new amendment** and law by the state attorney general last spring, holding that municipally owned electric utilities are "proprietary" functions of the governments.

## PUBLIC RELATIONS

**The answer to high bill complaints** does not fully rest upon customer understanding. This is the conclusion reached by Connecticut Light & Power Co after conducting opinion surveys among carefully cross-sectioned segments of its customers.

**An educational program helps reduce the incidence** of seasonal high-bill complaints but does not appear to change substantially the customer's attitude toward a high bill. This is particularly true for the high-use customer.

**CL&P found that only 10% of the sample** could pick from a list the three major causes of higher electric bills in winter. The three causes are (1) Lights burning longer, (2) Furnace blower running longer, and (3) Colder water to heat.

**Hoping to rectify the situation,** CL&P sponsored a popular local TV show. During the commercials, an artist-commentator linked weather and short daylight hours with high bills. In addition, the company pursued an advertising campaign in newspapers.

**A year later, a follow-up opinion survey showed** that about 22% of the sample could identify properly the three major causes of high winter bills. And men with customer contacts estimated that vocal complaints had dropped 10% to 50%.

**But the survey also showed that customers,** particularly high-use customers, still felt that their bills were "too high."

**Education of this nature isn't the complete answer,** therefore. Some good, strong way must be found to sell the customer effectively on the value of electric service. As high bills will pose a more acute problem in the future, EW's Reader's Forum department will welcome letters describing methods of attack tried by individual utilities, and with what result.

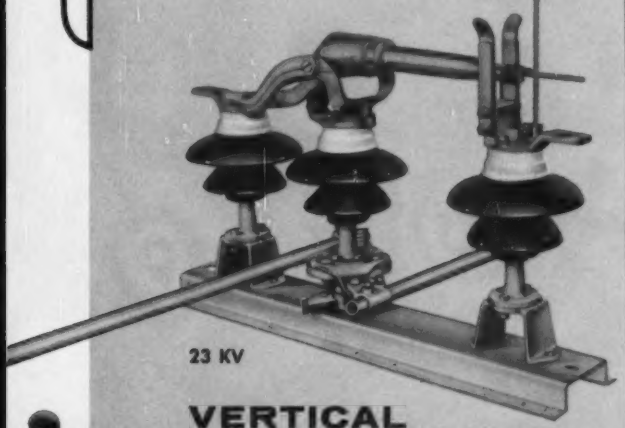
## EMPLOYEE RELATIONS

**Toledo Edison Co and Local 19 of Office Workers Union agree to 11¢ an hour** wage boost. Agreement, reached after negotiations were started under a wage reopener clause in the present contract, which expires next June 3, covers 378 Edison office workers.

## AQUISITIONS

**Austin, Quebec, Canada, Electricity Co-operative members have voted to sell** their system to Southern Canada Power Co.

# ENGINEERED



23 KV

## VERTICAL BREAK SWITCHES

### 7.5 to 230 KV
### 400-600-1200 Amps.

The design simplicity of these new vertical break switches permits exceptionally easy installation, completely dependable operation with minimum maintenance, yet incorporates all the features power men want for substation and pole top switching.

### TYPE H1 ROTATING STACK SWITCH

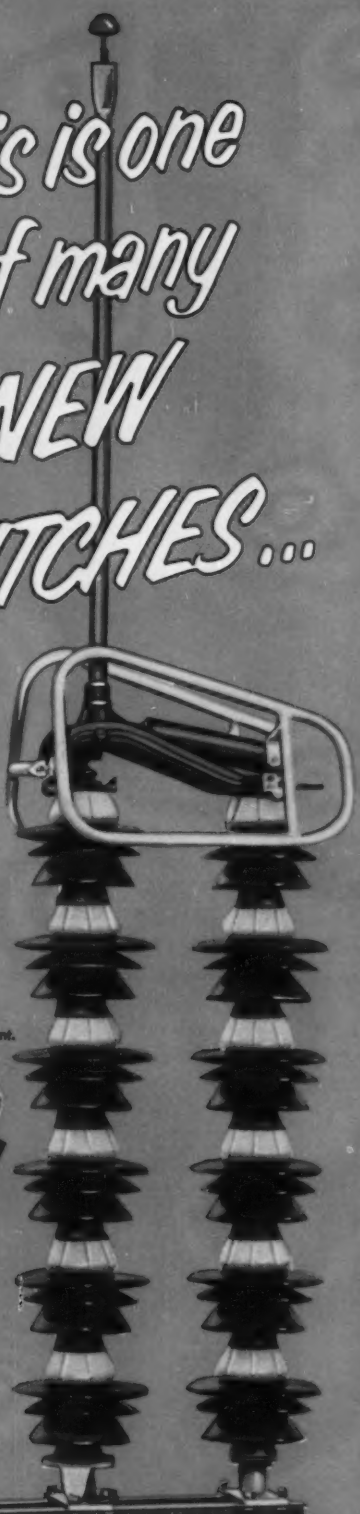
A simplified blade-actuating mechanism, with only three moving parts, gives years of dependable switching in any kind of weather. The highly conductive current path has braidless, sealed silver-to-copper hinge contacts and *high pressure* silver-to-copper adjustable jaw contacts. Type H1 Switches meet all AIEE and NEMA Standards.

230 KV (1050 BIL)

# "This is one of many NEW SWITCHES..."

**...you'll see in this ad on our completely modernized line... all designed to meet today's increasingly complex systems."**

C. A. "Chuck" Liming,
A. B. Chance Company,
Sales Manager,
Power Switching Equipment.

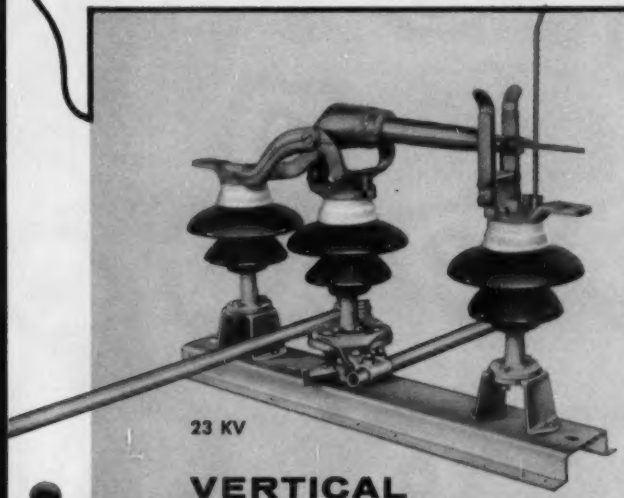


*Serving the Utility Industries since 1907*

50 YEARS

A. B. CHANCE COMPANY

# ENGINEERED to give you bett



23 KV

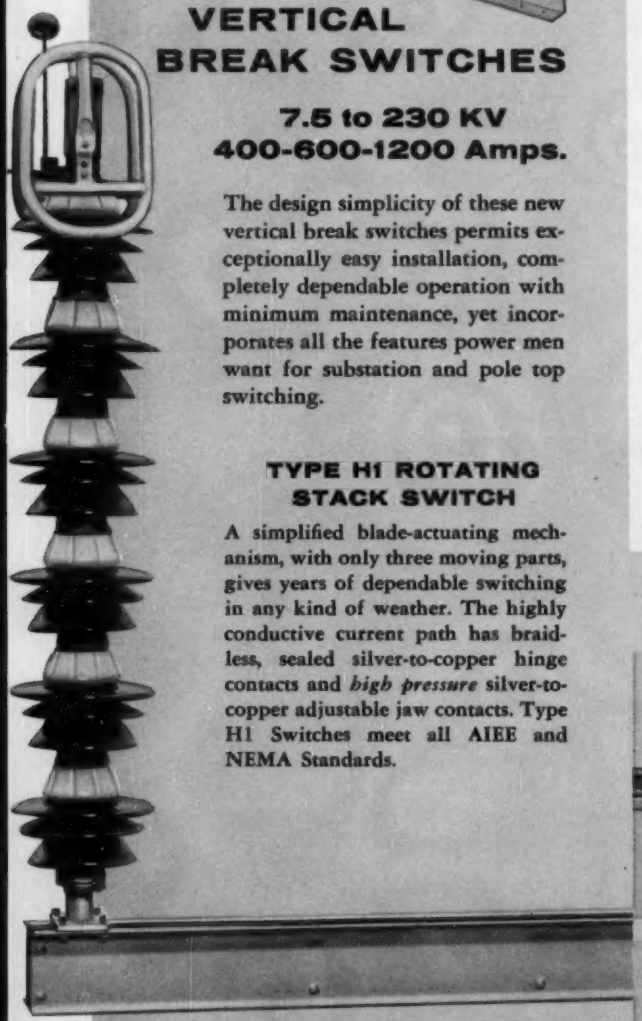
## VERTICAL BREAK SWITCHES

### 7.5 to 230 KV
### 400-600-1200 Amps.

The design simplicity of these new vertical break switches permits exceptionally easy installation, completely dependable operation with minimum maintenance, yet incorporates all the features power men want for substation and pole top switching.

### TYPE H1 ROTATING STACK SWITCH

A simplified blade-actuating mechanism, with only three moving parts, gives years of dependable switching in any kind of weather. The highly conductive current path has braidless, sealed silver-to-copper hinge contacts and *high pressure* silver-to-copper adjustable jaw contacts. Type H1 Switches meet all AIEE and NEMA Standards.



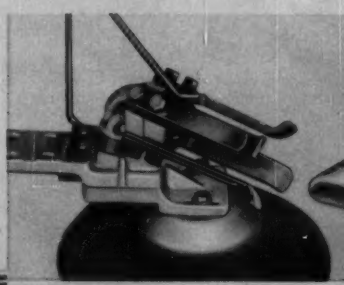
230 KV (1050 BIL)

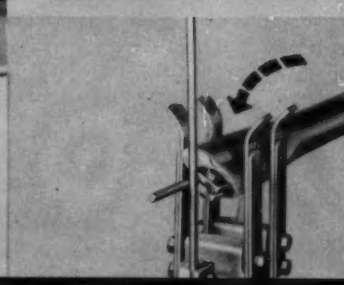
### Type S Side B

Here's a ruggedly-built, eco
alizing, disconnecting, by-p
easy to install – to operate
strength and thermal capac
today's extremely high fault
Current path has braidless,
contacts and high pressure
jaw contacts. 7.5 through 6

**Type C Center Break Switch**
are available in ratings 41 to

## These Chance Sw





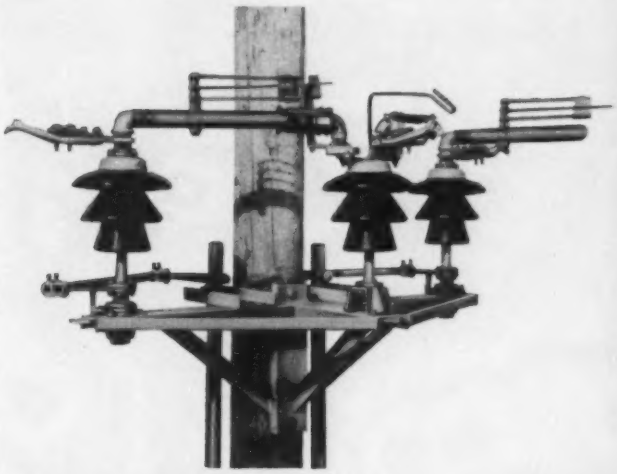
# etter system operation today and tomorrow!

## HORIZONTAL BREAK SWITCHES

### e Break Switch

, economical switch for section-
by-passing, and isolating. It is
erate – and has the mechanical
capacity necessary to withstand
fault currents without damage.
less, sealed silver-to-silver hinge
ure silver-to-copper self-wiping
gh 69 KV, 400-600-1200 Amps.

**witches,** with the same features,
1 to 161 KV, 600 and 1200 Amps.



### Type GS GOABS (Group Operated Air-Break Switches)

Designed for vertical phase-above-phase mounting on a single wood pole. This single pole mounting means lower initial and maintenance costs and minimum right of way requirements. Built with the performance features of the Type S Side Break Switch, GOABS also offer braidless current path construction with sealed silver-to-silver hinge contacts and *high pressure* silver-to-copper jaw contacts. GOABS feature all-welded, completely assembled frames—installation time is minimized. Full NEMA Rated—7.5 to 69 KV, 400-600-1200 Amps. 2-way and 3-way.

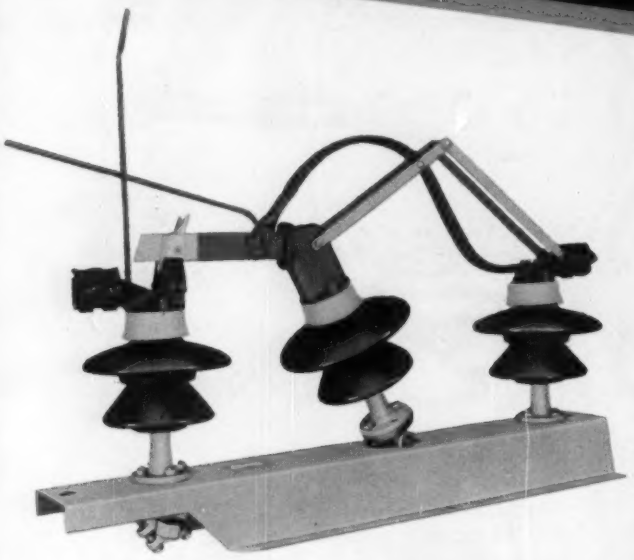
## Switches have self-wiping high pressure contacts

Jaw and blade contacts of these Chance Switches are all designed to provide effective self-wiping action to clean the contacts without abrasion each time the switch is opened or closed. Contacts are silver-to-copper for highest conductivity and have mechanically applied high pressure to positively hold the switch blade in position under heavy short circuits or surges.

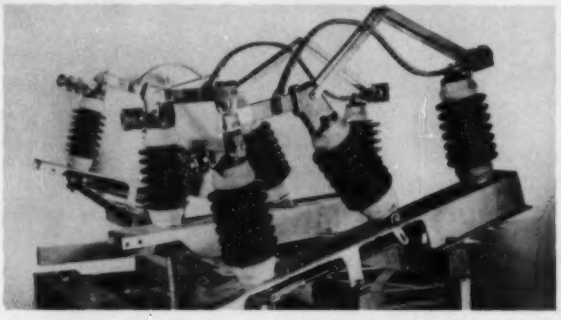
**Top illustration** shows the basic design used in horizontal break switches. Pressure is accurately adjusted at the factory, but field adjustment can be made with a wrench if desired.

**Lower illustration** shows how high pressure is applied on the vertical break switch jaw end. Flattened blade rotates into the jaw contact, deflecting the contact shoes to create the high pressure with minimum operating effort. Contact shoes are kept under constant pressure by non-current carrying beryllium copper springs.

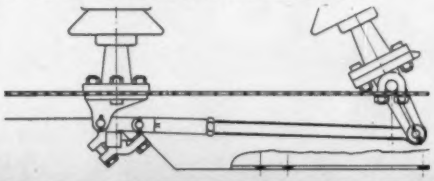
# "COMPENSATOR CONTROL" . . . Your most important reason for selecting Chance Tilting Insulator Switches



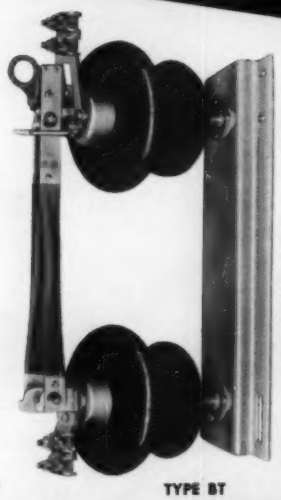
Even the most extreme warping of crossarms will never distort the mounting of gang-operated switches as greatly as the torture rack test shown at right. But even if it did—Chance Type WN or VN SWITCHES would still open and close uniformly and easily. The reason?... Chance Compensator Control that operates each phase independently of the others—that eliminates closing shock and gives extra leverage for smooth, effortless operation. Compensator Control also keeps the operating force in line with the blade motion.



There are other features you'll like, too—easy installation of the interphase shaft without "threading"... extra wide tilting insulator mounting that eliminates sideplay... deep-drawn bases to protect the operating mechanism... flanged edges that won't cut into wood supports... ice-breaking "crowbar action" of the blade, made possible by a pivoting pin in the blade, that makes it easy to open or close these switches under the most severe ice conditions.



## CHANCE Disconnect Switches ruggedly built for extra years of service



CS57-4

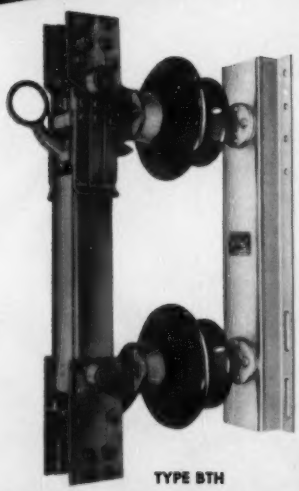
TYPE BT

Reliability of operation and reliability of performance are design characteristics of the Chance BT line of hookstick disconnect switches. Rigid blade design and self-aligning contacts mean positive closing even when it is necessary to operate with heavy side thrusts. Blade latch and centered contact pressure hold switches securely closed against heavy current surges. Pry-out action gives extra leverage for easy opening. 7.5 through 115 KV, 200 to 1200 Amps.

**NEW 2000 Amp. Type BTH—7.5 through 46 KV**

Features *high pressure,* silver-to-copper contacts; toggle-action of jaw applies high pressure with minimum operating effort. Double blade-latch holds switch firmly in closed position; releases easily with a pull of the hookstick.

Rugged, straight-through design provides high conductivity path; rigid square-hollow blade and bus-bar copper construction give security against damage from heavy fault currents.

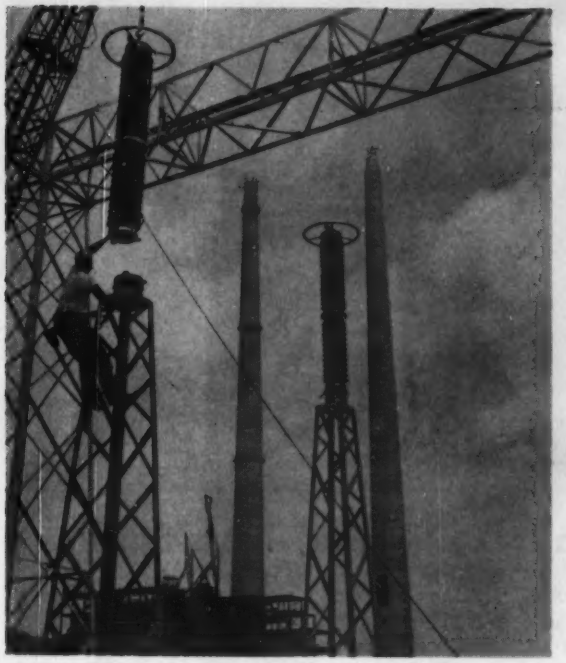


TYPE BTH

**Descriptive Bulletins on all these new Chance Switches are yours for the asking. See your Chance Switch Representative, or write A. B. Chance Company, Centralia, Mo.**

# A·B·CHANCE CO·

ABC INDUSTRIES



# O-B's New Arresters Go On 345-kv Duty

Smaller, lighter lightning arresters have gone into part of American Gas & Eelectric Co's 345-kv system. On August 30 Ohio Brass Co's new Thorex Dynagap arresters were installed at Ohio Power Co's Kammer High Voltage Switching Station, part of the AG&E system.

Their reduced size and weight allowed economy in the supporting structures at the station.

Height of this Type MPR arrester is the same as that of an equivalent insulator stack. Because of that feature two of the poles were made to serve a dual purpose. In addition to their normal role they also function in place of insulators to stabilize long flexible jumpers against wind sway.

## Generators Ordered for Niagara Project

Electric generating equipment for the Niagara Power project of the New York State Power Authority will be built by Westinghouse Electric Corp and a combined venture of Baldwin-Lima-Hamilton Corp with Newport News Shipbuilding & Dry Dock Corp. Located in this Lewiston Power Plant will be 13 hydro-electric generating units.

With a maximum dependable capacity of 1,800 Mw, the Niagara project when completed will become the largest hydro-electric project east of the Mississippi River and the second largest in the United States. Only Grand Coulee hydrostation in Washington State has a greater capacity.

An order for thirteen 167,000-kva waterwheel generators was awarded Westinghouse Electric Corp, East Pittsburgh, Pa. The units represent the largest single order of its kind placed to date in the United States.

First unit is scheduled for delivery by Sept. 1, 1959. Preliminary estimates indicate that shipment of the parts for only one generator to the Niagara site will require 34 railroad cars.

A letter of intent has been issued by the Power Authority to Baldwin-Lima-Hamilton Corp, Eddystone, Pa., and Newport News Shipbuilding and Dry Dock Co, Newport News, Va., in a joint venture to furnish the thirteen hydraulic turbines to drive the generators. The combined turbine bid totalled $20,415,600.

Each turbine will have a rated capacity of 200,000 hp at 120 rpm, when operated, for best efficiency, under a 300-ft head. They will have a capability of more than 240,000 hp under effective head of 315 ft.

B-L-H will build seven turbines and NNS&D the other six units and spare parts. First shipment of the imbedded parts for the first turbine is to go forward for delivery Feb. 1, 1959 at the job site.

### R&IE Has 46-kv Recloser

An automatic circuit recloser for 46-kv-maximum service will be marketed by R&IE Equipment division of I-T-E Circuit Breaker Co, Greensburg, Pa. Interrupting rating is 3,000 amp rms symmetrical at 46 kv, and 4,000 amp at 34.5 kv. The cycle-instantaneous tripping of transient faults and reclosing operations reportedly provides low-cost improvement of service reliability at the higher voltages.

### Ward LaFrance Produces Utility Truck Bodies

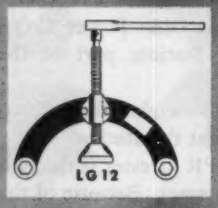
Truck bodies for electric utilities are now being marketed by Ward LaFrance Truck Corp, Elmira, N. Y., states F. Norman Tracy, the company's president. This is another division of Ward LaFrance, producer of a line of fire apparatus, custom built trucks and special purpose trucks.

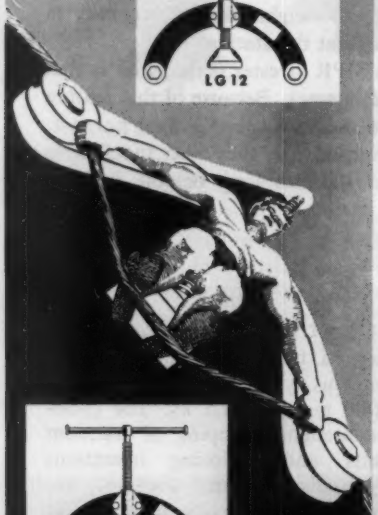
The company has recently completed the first truck of a 12-unit fleet for an eastern utility. The truck features the Emhart Skyworker boom, operable by hydraulic controls by one man in the worker's bucket and on the truck.

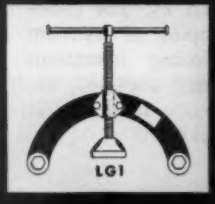
(*More M&M on page* 142)

LITTLE
Giant
SLACK PULLER

For pulling slack in a messenger you need a man with the strength of Hercules, the ruggedness of Atlas, the speed of Mercury . . . or a Little Giant Slack Puller.



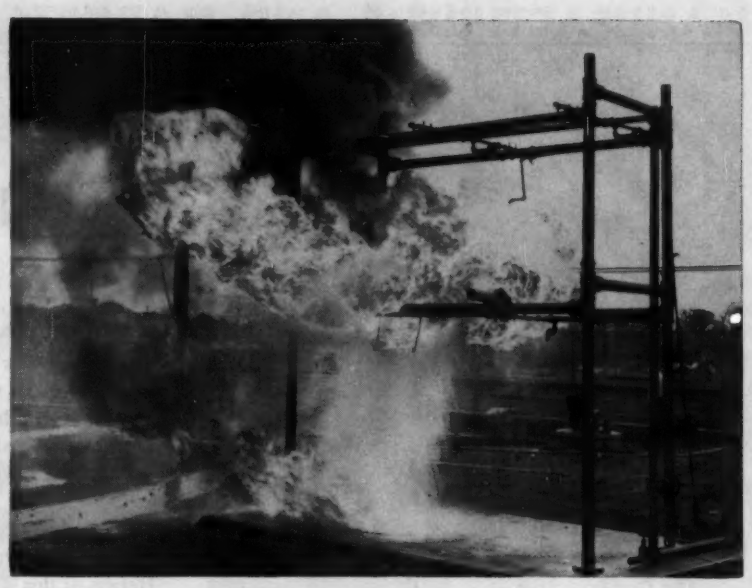



If you need to pull slack in a messenger for any reason, either of the Little Giant Slack Pullers, the LG1 slip handle or the LG12 ratchet handle will do the job Quick, Easy and Safe.

WRITE OR PHONE

SERVING THE GROWING INDEPENDENT TELEPHONE INDUSTRY
CABLE SPINNING EQUIPMENT CO.

3100 TOPEKA AVE.
TOPEKA, KANSAS



## Water Can Lick Oil Fires, Tests Show

Lubricating oil fire ignited by a leak to hot steam pipes was simulated in a series of tests conducted by Grinnell Co at its Cranston, R. I., test station for utility and consulting engineers late last month. This fire was extinguished by water spray but required a continuing flow of water to cool the pipes below the reignition temperature of the oil.

Other tests in the series included the burning of 100 gal of oil spilled from a leak in the cover of a large power transformer. After 70 sec of pre-burn to raise temperatures, such a fire was extinguished completely by 35 sec of water spray from a 1,100-gal tank pressurized to 67 psi by bottled nitrogen. This installation simulated one recently installed by Philadelphia Electric Co (EW, Feb. 4, p 56). The spray continued a full minute after extinction to guard against spontaneous reignition of the spilled oil.

Similar fires were extinguished by spray from nozzles of several types supplied at 40 psi from the laboratory water mains in 38-55 sec. Neither foam nor $CO_2$ were used, because water proved adequate to extinguish oil fires.

## Simplex Cable Will Link U. S.-Europe

An undersea telephone cable system will connect the United States and Canada with France and Germany. Contracts were signed recently by American Telephone & Telegraph Co and agencies of the two European countries. Construction is expected to be completed in 1958.

About 5,000 miles of cable are needed for the project. It is to be manufactured by four companies: Simplex Wire and Cable Co at Newington, N. H., who furnished cable for three similar undersea projects (EW, Feb. 4, 1957, p. 97); and one manufacturer in each of three other countries—England, France, and Germany. Amplifiers, situated about 40 miles apart, are to be made by Western Electric Co at Hillside, N. J.

This $40-million, two-cable system is to have the same design as the first transatlantic link (U. S., Canada and England) which opened for service in 1956 (EW, Oct. 8, 1956, p. 59). The deep-sea portion will extend 2400 statute miles. Scheduled for service in 1959, the cable will provide 36 voice circuits —13 to France, 13 to Germany, and

10 are reserved for other European countries. To operate the system about 2800 v, d-c, will be required at Clarenville, Newfoundland, and at Penmarch, France.

## U. S. Copper Production Up

Primary copper production in the United States for August was 89,312 tons, according to the Copper Institute, New York. This amount is an increase of some 3,170 tons over July production. Refined production totalled 128,480 tons for August, up 1,046 tons from the preceeding month. Copper deliveries to fabricators amounted to 107,522 tons, compared to only 84,702 tons for the previous month. Refined stocks at the end of August totalled 192,931 tons, about 1,415 tons increase above the amount at the end of July.

## *M & M BRIEFS*

**Weston Electrical Instrument Corp,** Newark, N. J., a subsidiary of Daystrom Inc, has opened a District Sales office at 16,607 James Couzens Highway, Detroit. T. S. Cawthorne has been appointed District Manager.

**A. B. Chance Co,** Centralia, Mo., is now offering its "z.l.n." electrical contact aid in a plastic 8-oz "squeeze" bottle. This contact aid is an adhesive for bi-metal connectors.

**Narda Ultrasonics Corp** has been formed to provide ultrasonic cleaning machines and metal working equipment. Capitalized at about $250,000, the firm is a subsidiary Narda Microwave Corp, 160 Herricks Road, Mineola, N. Y. Headquarters are integrated with the parent company. Paul M. Platzman is vice president and sales manager of the subsidiary.

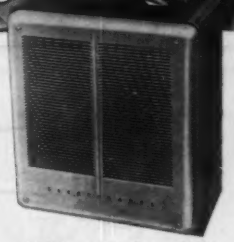
**Contacts Inc** has been formed in Wethersfield, Conn., to make electrical contacts exclusively. Now available from the company are solid headed contacts of precious metals and their alloys. Line of contacts will be enlarged in the near future.

. . . *Priced Right to Suit YOU*

**ELECTROMODE**

**Automatic Electric**

**PORTABLE HEATERS**



***Instant Heat — Wherever Needed***

These powerful new heaters give abundant fan-circulated heat for big rooms, safely and quickly. Enable the family to use the whole house, anytime. Equipped with a 6-foot cord and plug and convenient carrying handle. Built-in thermostat provides automatic room temperature control.

Ideal for use in basement game room, work shop, laundry; expansion attic; cottage; garage; big hard-to-heat rooms.

| Model | Cat. No. | Volts |
|---|---|---|
| PA-32 | 3995-S | 240 |
| PA-36 | 3995-T | 208 |
| PA-48 | 3995-U | 240 |

***NEW DESIGN***
Modern Streamlined

***NEW COLOR***
Tutone Driftwood

***NEW CAPACITIES***
3200, 3600, 4800 watts

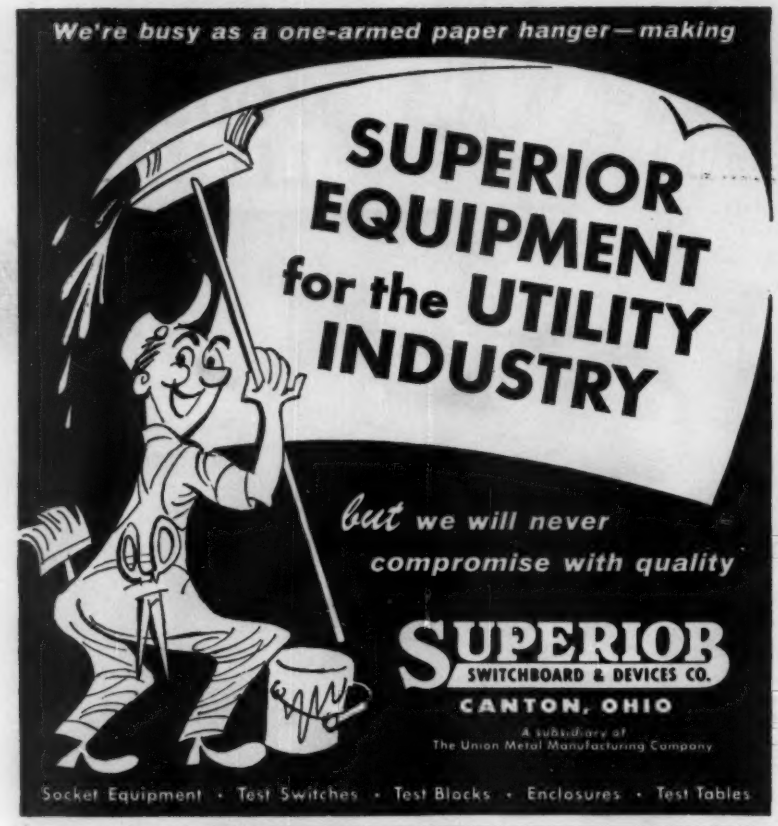
**100% SAFE** because of the completely sealed-in, cast-aluminum heating element—an Electromode exclusive feature. There are no open wires and no glowing coils, and there is no danger of fire, shock or burn. Equipped with automatic safety switch and quiet heavy duty motor.

***ELECTROMODE the LEADER***

For more than a quarter century Electromode has concentrated on one specific industry—heating by electricity. And Electromode has continued to expand its line to include the most modern developments in electric heating equipment to serve the needs of HOME-INDUSTRY-FARM.

SEND FOR FREE descriptive literature with complete specifications.

ELECTROMODE
Division Of
COMMERCIAL CONTROLS CORPORATION
Dept. EW-107
45 Crouch Street
Rochester 3, N. Y.


We're busy as a one-armed paper hanger—making
SUPERIOR EQUIPMENT for the UTILITY INDUSTRY
but we will never compromise with quality
SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of
The Union Metal Manufacturing Company
Socket Equipment • Test Switches • Test Blocks • Enclosures • Test Tables

*You're on target...in Electrical World*

**if you want to reach anyone concerned with the large-scale generation, transmission, distribution or utilization of electricity . . . because that's the length, breadth and height of ELECTRICAL ORLD's audience of 26,000 *all-paid* subscribers . . . in the utilities and big industry, among electrical manufacturers and consultants. No other magazine covers the *entire* Electric Power Industry, no other magazine commands the loyal attention of the industry. For further fast, fact-full information, write for "Quick Facts" . . . Electrical World, 330 West 32nd St., New York 36, N. Y.**


## SEE Meets

(*Continued from page* 79)

to the top of the piling is a precast H-shaped cap.

Dimensional standards for bushings in the 115 to 230-kv classes have been agreed on, reported T. J. Allen, Georgia Power Co. And as soon as they are approved the new standards will be published.

These standards do not provide complete interchangeability, said Allen. Transformer bushings, usually of a lower current rating, cannot be used on circuit breakers. But OCB bushings can be used on transformers insofar as the length below the flange permits.

Operating experience with leased lines for transfer trip and supervisory control has been satisfactory, declared W. W. Valentine and M. L. Byrne, Potomac Electric Power Co. But there has been a large element of luck in that faults have not occurred during times of leased-line outages.

### More Autotransformers

More and more autotransformers will be applied to power systems, predicted L. W. Schoening, Allis-Chalmers Manfacturing Co. But when evaluating possible applications, he said, consideration must be given to three major items: Affect of ground on line-to-neutral voltage; affect of third harmonic on stability and interference; and, affect of switching and impulse surges on insulation.

In discussing the advantages and application of transformers with a two-step reduction in BIL, J. M. Clayton, Westinghouse Electric Corp, said that lightning arresters should be as close to the transformer as practicable. Arresters rated at 75% provide best protection. If arresters must be rated above 80%, a two-step reduction should not be considered.

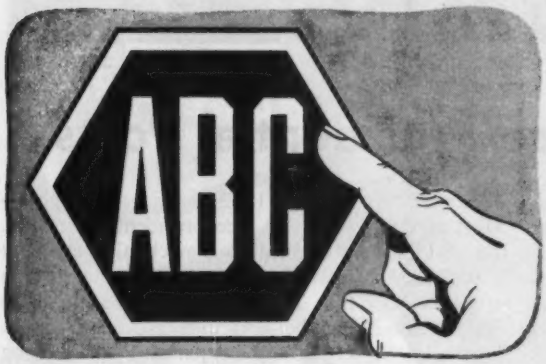
For serving heat-pump and air-conditioning loads, economics favor single-phase for units through 5 hp, reported H. E. Campbell, General Electric Co, in a paper presented by J. C. Hartley. Customer wiring savings realized through the use of single-phase units balances the higher equipment cost. Benefits for the utility include lower installed cost, better power factor,

(*Continued on page* 152)

# Who's Minding The Store?

## . . . in the magazine publishing business, it's

The Audit Bureau of Circulations (ABC) is a cooperative organization that sets standards of good business conduct for its publisher members. Twice each year ABC auditors carefully scrutinize the entire circulation structure and operation of every member magazine. In a very real sense, therefore, they are "minding the store" — making sure that no false or misleading claims are made regarding the size or composition of a magazine's audience.




**McGraw-Hill** is a charter member of ABC and has supported its aims continuously for over 40 years. We believe this membership serves you by providing full assurance that every subscriber to McGraw-Hill magazines displaying the ABC symbol is paying to receive his copies.

**Accurate Figures** — about you are the heart of ABC's job. ABC does a candid, unbiased, certified audit of all subscription figures of member magazines — and of the subscribers' jobs, functions, and locations. These audits help editors to tailor the contents of their magazine to your specific job interests.

**You're the boss** when you pay money for any magazine. Your vote of confidence and your renewals of subscriptions are dominant in the thinking of editors and publishers. Advertisers are vitally interested, too, and their support helps earn the dollars needed to do a stronger, more useful editorial job for you.

**You, the subscriber,** win when you buy business magazines that hold membership in the Audit Bureau of Circulations. The ABC symbol signifies that the publication to which you subscribe makes every effort to provide you with the type of informatin you need to do a better, more effective job. It also indicates that the publisher maintains the highest standards of business ethics.

**McGRAW-HILL PUBLICATIONS**

McGRAW-HILL PUBLISHING COMPANY, INC.

330 WEST 42ND STREET, NEW YORK 36, N. Y.

DORSEY F. HUGHES

GEORGE C. McCABE

L. W. CADWALLADER

CHARLES L. CARR

# PEPCo Elects Four to Vice Presidential Posts

Four newly elected vice presidents of Potomac Electric Power Co are Dorsey F. Hughes, who becomes vice president and electrical engineer; George C. McCabe, vice president and manager of the electric system; Lewis W. Cadwallader, vice president and mechanical engineer; and Charles L. Carr, vice president and controller.

Hughes, electrical engineer since May, 1956, has been with the utility for the past 23 years. Most of this time he has spent in the distribution engineering division, aside from a short period when he served as assistant to the manager of the electric system.

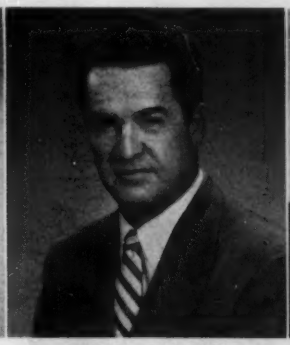
McCabe has been manager of the electric system for almost four years. He had been associated with PEPCo's engineering activities from 1933 to 1952, when he became assistant to vice president-operations.

Cadwallader, mechanical engineer since January, 1954, came to the firm in 1933. Since that time he has held various positions in the generating department, including general superintendent.

Carr, a 26-year PEPCo veteran, has been controller since 1951. He formerly was assistant controller.

ROBERT PAXTON

ARTHUR F. VINSON



JAMES H. GOSS

HALBERT B. MILLER

# GE Assigns New Positions to Four Executives

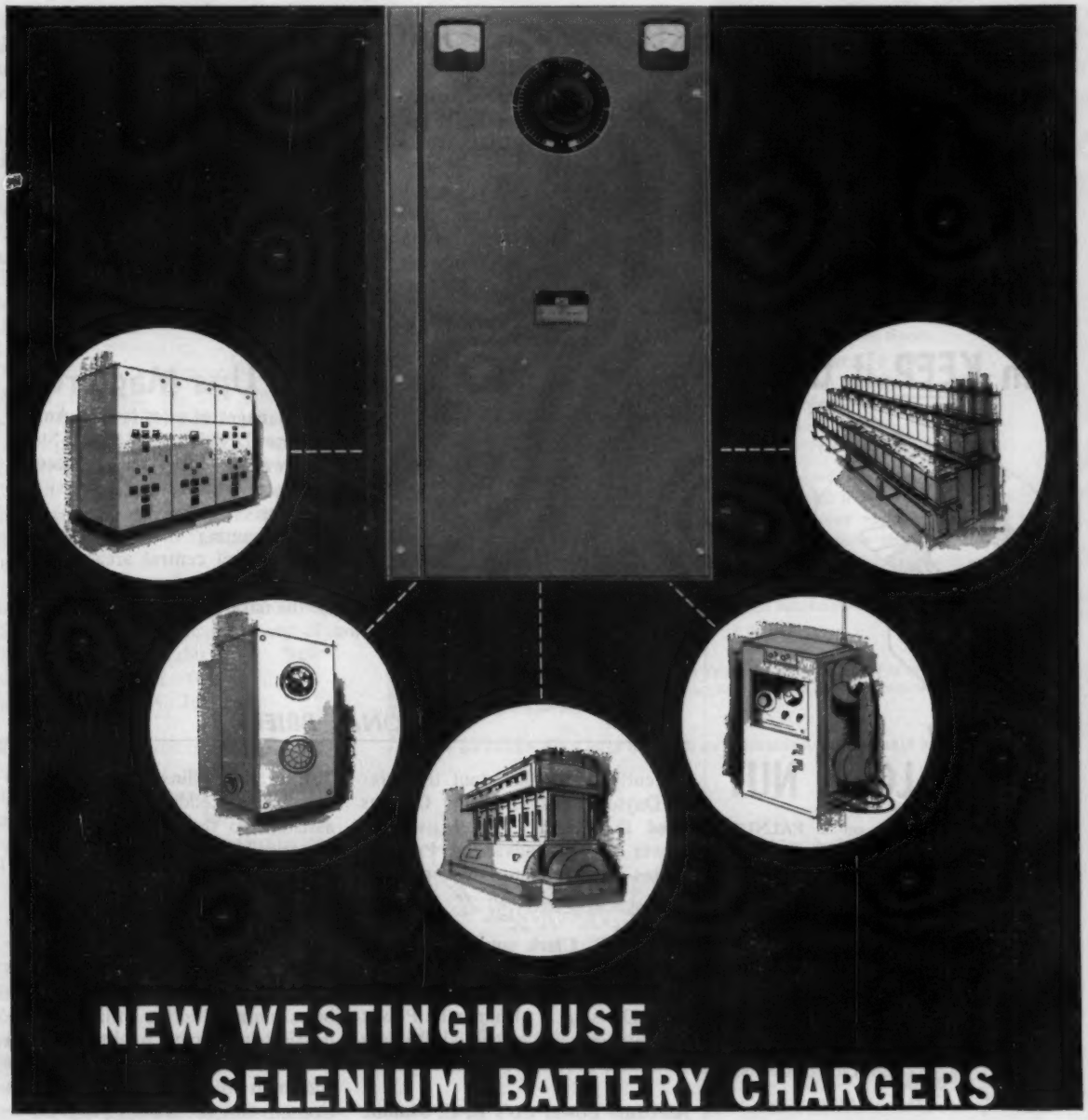
In a series of executive changes, General Electric Co has advanced Robert Paxton to the new post of executive vice president-operations, Arthur F. Vinson to vice president and group executive-consumer group, James H. Goss to vice president and group executive-apparatus products groups, and Halbert B. Miller to vice president-manufacturing services.

Paxton was also elected to the board of directors. He will now be responsible for the firm's four operating groups: apparatus; consumer products; electronic, atomic, and defense systems; and industrial components and materials.

Vinson, succeeding Paxton, is former vice president manufacturing services. During his 28 years with GE he has held engineering, manufacturing, and general management positions.

Goss, a 26-year GE employee, previously was president of Canadian General Electric Co, Ltd. J. Herbert Smith now assumes that post.

Miller most recently served as general manager of the home laundry department, appliance and television receiver division.



# NEW WESTINGHOUSE SELENIUM BATTERY CHARGERS

## *OFFER LONGEST LIFE, QUIETER OPERATION, NO MAINTENANCE*

Whatever your battery-charging requirements, you'll find the economical answer in Selenium Battery Chargers by Westinghouse.

Westinghouse chargers will handle all types of batteries. They are designed for either cyclic or trickle charging operations in a wide variety of applications, including switchgear control, signal, engine starting, communication and powerhouse batteries.

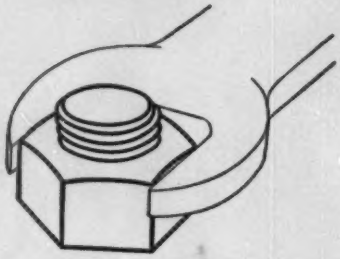
Offering maximum return on your investment, these chargers, built with Westinghouse selenium stacks, made by vacuum process, combine longer life with higher efficiency . . . eliminate wear through the exclusion of all moving parts . . . reduce operating noise level through convection cooling.

For more information about Selenium Battery Chargers for your specific requirements, contact your Westinghouse sales engineer. Or, write to Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pa. Ask for descriptive bulletin 19-200.

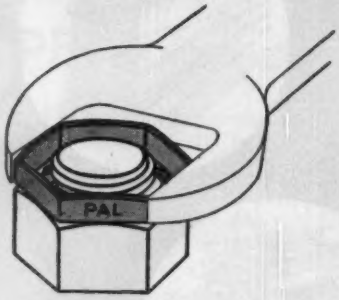
J-22068

YOU CAN BE SURE...IF IT'S Westinghouse

Get it tight —



then KEEP it tight




*with a*

PALNUT LOCK NUT

JUST spin on a PALNUT Lock Nut and lock with 1/3 turn of a wrench. Takes but seconds, cost is negligible, protects for the life of the installation. PALNUT Lock Nuts exert a double locking action that prevents the plain nut from loosening and the bolt from backing out, under severest vibration. Eliminates further checking or re-tightening on mechanical assemblies —maintains perfect conductivity on electrical connections.

*Widely Used Thruout Utility Field*

PALNUT Lock Nuts have been used for years on wood poles, steel towers, fittings, connectors, switches, hardware, transformers, etc. Complete range of sizes, in all finishes and materials used by utility industry. Get Bulletin #577.

THE PALNUT COMPANY

51 Glen Road
Mountainside, N. J.

PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost


## KU Advances Johnson

Kentucky Utilities Co has promoted Henry L. Johnson to general superintendent. As such, he is responsible for KU's 10 generating stations.

Johnson comes to his new position after serving as production engineer of power plants since 1953. Since joining KU in 1931 he has also been electrician, commercial service engineer, district manager, assistant division engineer, and assistant plant superintendent.

## U. S. Steel Ups Maguire

New general manager of sales for the American Steel & Wire Division of United States Steel Corp is Howard B. Maguire. He succeeds Maxwell D. Millard, who was named assistant vice president-sales.

Maguire, in assuming his new position, relinquishes the post of central area manager of sales which he has held since 1949. He will now supervise the nationwide sales activities for the division.

## PERSONAL BRIEFS

Recently named assistant treasurer of Dayton Power & Light Co was **Fred D. Frantz** . . . Mississippi Power Co has advanced **Paul G. Mains** to Meridian Division manager.

**William E. Clark** succeeds retiring **James R. Jarvis** as superintendent of Utah Power & Light Co's Salt Lake Division . . . Bonneville Power Administration has named **William Galbraith** Portland area manager.

Alabama Power Co's **E. C. Malone** has been designated assistant to **L. M. Smith,** new vice chairman of the board. **Hugh P. Foreman** becomes assistant to the president.

Recently promoted by Public Service Electric & Gas Co were **Willard A. Burnett,** to chief accountant in the controller's department; **Lewis R. Fay,** to assistant controller; **James E. Daborn,** to assistant chief accountant; and **Henry M. Hobson,** assistant to the controller.

**Walter K. Conover** has advanced to general supervisor of publicity and sales promotion at Pennsylvania Power Co.

**Ashton B. Collins, Jr.,** has joined the staff of Reddy Kilowatt, Inc, as assistant to the president . . . At Ontario Hydro, **Robert H. Hillery** is new director of operations.

**Edward C. Madden** is newly appointed secretary of the Massachusetts Department of Public Utilities . . . **Judge R. Lee Whitmore** has been named to the Utilities Commission in North Carolina . . . In Hawaii, **Roger S. Ames** is new chairman of the Public Utilities Commission and **James M. O'Dowda** became a commissioner.

Benjamin Electric Manufacturing Co has elected **John R. Bartizal,** chairman, to the additional post of president; **J. H. Fall, III,** as vice president-treasurer; and **George A. Hamm** as vice president. He continues as secretary.

**James A. Kerr** is new director of advertising and public relations for Federal Pacific Electric Co . . . Nordberg Manufacturing Co has appointed **James T. Wilson** as a special representative of the firm's subcontracting and new products department.

General Electric Co's **Larry Jennings** retired October 1 as consultant-trade relations, Marketing Services Division.

Allis-Chalmers Manufacturing Co has advanced **Robert L. Halsted** to general manager of the Industrial Equipment Division to succeed **P. F. Bauer,** now managing director of A-C International, a new operating division. **Edward H. Baxa** becomes manager of the A-C processing machinery department.

**Dr. R. E. Fox** was recently named section manager in the Westinghouse Research Laboratories' physics department. He will supervise the ultra-high vacuum research for Project Sherwood, AEC's program for harnessing controlled thermonuclear reactions for peacetime power purposes.

**Isaac R. Dunlap** joins Brown Co to direct research and development of the firm's Onco products . . . New sales manager of Wenz Electric Sales is **Bennett W. Johnson.**

Rockbestos Products Corp has elected **Leonard W. Smith** as treasurer and **Elmer Barth** as assistant treasurer . . . **Irving M. Converse** has assumed the post of controller of Thor Power Tool Co.

## OBITUARY

**Bernard C. Cobb,** 87, former cofounder, president, and board chairman of the Commonwealth & Southern Corp, died recently in his summer home at Altamont, N. Y. During his long utility career, from which he retired in 1934, Cobb was associated with Allied Power & Light Corp as chairman, Penn-Ohio Edison Co as president, and Commonwealth Power, Railway, & Light Co as co-founder and officer.

**Joseph L. Scheinis,** 63, manager of the corporate finance department of Ebasco Services, Inc, died suddenly in a New York City hospital following a cerebral hemorrhage.

**Frank H. Sommer,** 84, chief counsel of the department of Public Utilities of New Jersey's Board of Public Utilities Commissioners, died recently.


PAGE chain link FENCE

America's First Wire Fence—since 1883

**Why a PAGE Fence is the RIGHT Fence for YOU . . .**

**You can choose from—**

**—8 Fence Styles**
**—8 Fence Heights**
**—4 Fabric Metals**
**—2 Types Metal Posts**
**—Top Rail or Top Wire**
**—Single or Double Extension Arms**
**—6 Gate Styles, Many Widths**

• Your protective PAGE FENCE can be comprised of units that best meet your individual needs or preferences. All are quality-controlled by PAGE from raw metal to finished units ready for assembling. Your PAGE FENCE will be planned and expertly erected to meet engineering standards by a reliable, long-experienced firm permanently located in your vicinity, knowing local conditions affecting fence, and having lasting interest in every fence it installs. For illustrated PAGE information and name of nearest firm . . .

*Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.*

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

REMEMBER . . . in the dynamic electric power industry. only World* can do World's* work . . . * Electrical World that is . . .

F & H Self-Powered HOLE DIGGER

The modern way to dig holes. No expensive installation. Fits on any A frame. Equipped to dig holes 8' deep and up to 20" in diameter. One man operates digger as all controls are mounted on machine. Available in 8-HP and 14-HP models. Auger is cleaned by spinning. Digs anchor holes with ease. Write for full information. Film of machine in operation available on request.

Manufactured by

FOUSHEE & HECKENDORN

P. O. BOX 65,

CEDAR POINT, KANSAS

# MEETINGS CALENDAR

## OCTOBER

**Interstate Power Club**—Hotel Martinique, New York City, Oct. 14.

**Pennsylvania State University**—Electric Utility Company Managers Seminar, State College, Pa., Oct. 14-16.

**American Society of Civil Engineers**—Annual Meeting, Hotel Statler, New York City, Oct. 14-18.

**American Institute of Electrical Engineers**—Computers in Control Symposium, Hotel Claridge, Atlantic City, N. J., Oct. 16-18; 3rd Annual Farm Electrification Conference, Hotel Nicollet, Minneapolis, Minn., Oct. 29-31.

**Southeastern Electric Exchange**—Sales Section, Dinkler-Tutwiler Hotel, Birmingham, Ala., Oct. 16-18.

**Wisconsin Utilities Association**—Electric & Gas Sales and Operating Sections Convention, Schroeder Hotel, Milwaukee, Wis., Oct. 16-18.

**Edison Electric Institute**—Transmission & Distribution Committee, Statler Hotel, Boston, Mass., Oct. 17-18; Insurance Committee, Dearborn Inn, Dearborn, Mich., Oct. 17-18; Accounting Division Taxation Accounting Committee, held jointly with AGA, Williamsburg, Virginia, Oct. 23-25.

**Pennsylvania Electric Association**—Relay Committee, Abraham Lincoln Hotel, Reading, Pa., Oct. 17-18; Systems Operations Committee, Bedford Springs Hotel, Bedford, Pa., Oct. 24-25; Transmission & Distribution Committees, Lord Baltimore Hotel, Baltimore, Md., Oct. 31-Nov. 1.

**National Society of Professional Engineers**—Fall Meeting, Grand Pacific Hotel, Bismarck, North Dakota, Oct. 17-19.

**American Society of Mechanical Engineers**—Lubrication Conference, sponsored jointly with American Society of Lubrication Engineers, Royal York Hotel, Toronto, Canada, Oct. 7-9; Power Conference, American Hotel, Allentown, Pennsylvania, Oct. 21-23.

**National Safety Congress**—Conrad Hilton Hotel, Chicago, Ill., Oct. 21-25.

**Engineers Council for Professional Development and Engineers Joint Council**—General Assembly, Statler Hotel, New York City, Oct. 24-25.

**Oklahoma Utilities Association**—Electric Light and Power Division, Woodward, Okla., Oct. 25; Eastern District, Bartlesville, Okla., Oct. 25.

**American Power Dispatchers Association, Inc**—Fall National Meeting, Fresno, Calif., Oct. 25-26.

**National Management Association**—34th National Conference, Penn-Sheraton Hotel, Pittsburgh, Pennsylvania, October 25-26.

**Atomic Industrial Forum**—Annual Conference, Coliseum, New York City, Oct. 28-30.

**American Nuclear Society**—Winter Meeting, New York City, Oct. 28-30.

**The University of Texas**—10th Annual Power Distribution Conference, Austin, Texas, Oct. 28-30.

**National Association of Railroad Utilities Commissioners**—Annual Conference, Peabody Hotel, Memphis, Tennessee, October 28-31.

**Industrial Management Society**—21st Anniversary Industrial and Management Clinic, Hotel Sherman, Chicago, Ill., Oct. 30-Nov. 1.

**Institute of Radio Engineers**—3rd Annual Technical Conference of the Professional Group on Electron Devices, Shoreham Hotel, Washington, D. C., Oct. 31-Nov. 1.

## NOVEMBER

**American Institute of Mining, Metallurgical and Petroleum Engineers**—Metals Division Fall Meeting, Morrison Hotel, Chicago, Nov. 3-7.

**American Institute of Electrical Engineers**—Ninth Annual Machine Tool Conference, Hotel Schroeder, Milwaukee, Wis., Nov. 4-6; Conference on Magnetism & Magnetic Materials, Sheraton Park Hotel, Washington, D. C., Nov. 18-21.

**Edison Electric Institute**—Accident Prevention Committee, Penn-Sheraton Hotel, Pittsburgh, Pa., Nov. 6-8; Area Development Committee, Phoenix Hotel, Lexington, Ky., Nov. 9; Southern Region Home Service Workshop, Atlanta, Ga., Nov. 12-13; Commercial Lighting Committee, Washington, D. C., Nov. 14-15; Accounting Division Advisory and Executive Committees, The Cloisters, Sea Island, Ga., Nov. 14-15; Street Lighting Committee, Dayton, Ohio, Nov. 21-22; Industrial Power & Heating Group, Atlantic City, N. J., Nov. 21-22.

• **Pacific Coast Electrical Association**—Hawaiian Conference, Reef Hotel, Honolulu, Hawaii, Nov. 7-8; Services Section, Villa Hotel, San Mateo, Calif., Nov. 13-14.

**Pennsylvania Electric Association**—Prime Movers Committee, Bedford Springs Hotel, Bedford, Pa., Nov. 7-8; System Planning Committee, Van Curler Hotel, Schenectady, N. Y., Nov. 7-8; Electrical Equipment Committee, Ben Franklin Hotel, Philadelphia, Pa., Nov. 14-15.

**Institute of Radio Engineers**—Third Annual Instrumentation Conference, Atlanta Biltmore Hotel, Atlanta, Ga., Nov. 11-13.

**National Electrical Manufacturers Association**—Traymore Hotel, Atlantic City, N. J., Nov. 11-15.

**American Standards Association**—Eighth National Conference, St. Francis Hotel, San Francisco, Calif., Nov. 13-15.

**Southeastern Electric Exchange**—Accident Prevention Committee, Dinkler-Tutwiler Hotel, Birmingham, Ala., Nov. 14-15.

**American Society of Refrigerating Engineers**—44th Semi-annual Meeting, Shoreland Hotel, Chicago, Ill., Nov. 14-16.

• **Air Conditioning & Refrigeration Institute**—10th Exposition, International Amphitheatre, Chicago, Ill., Nov. 18-21.

**Electric Companies Public Information Program**—Inter-Regional Committee, Mayflower Hotel, Washington, D. C., Nov. 19.

• **Public Utilities Association**—Region II Annual Conference, Mayflower Hotel, Washington, D. C., Nov. 21-22.

## DECEMBER

• **American Society of Mechanical Engineers**—Annual Meeting, Statler Hotel, New York City, Dec. 1-6.

• **Edison Electric Institute**—Accounting Division Electronics Seminar, sponsored jointly with AGA, Sheraton Cadillac Hotel, Detroit, Mich., Dec. 2-4; Industrial Relations Committee, sponsored jointly with New England Personnel Group, Sheraton Plaza Hotel, Boston, Mass., Dec. 5-6.

---

• Additions this week.

# Europe Power Use Up 9%

Consumption of electric power in Europe during 1956 reached 670 billion kwhr, an increase of about 9.4%, according to the Secretariat of the Economic Commission for Europe. In most countries the rate of increase exceeded 7.2%, a figure which represents doubling of consumption every ten years.

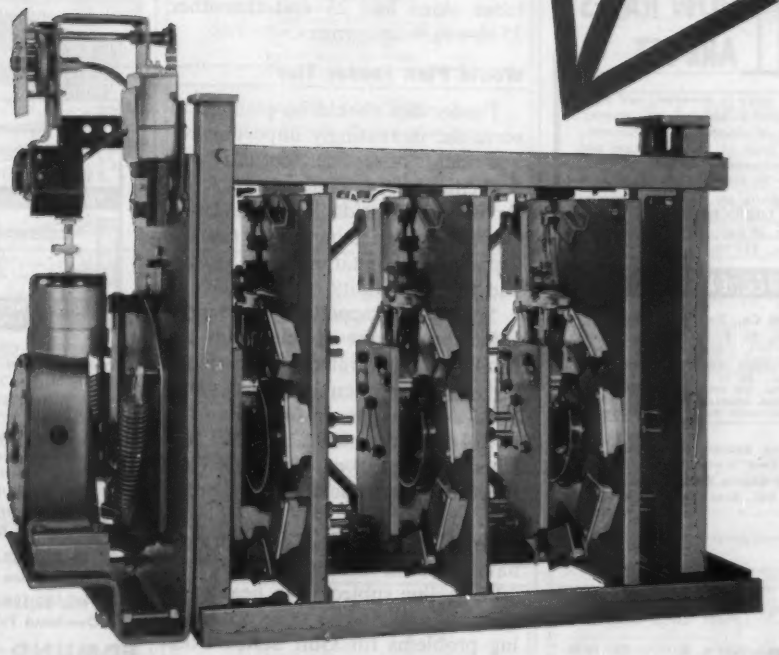
# reasons for remarkable service of ALLIS-CHALMERS 3-phase regulators

Simplicity of design is an important reason why the tap-changing mechanism of Allis-Chalmers regulators gives long, truly trouble-free service.

- All moving parts, including driving motor, are completely immersed in oil — nothing to lubricate or adjust.
- Countless gears and cams eliminated to reduce moving parts to a minimum.
- Simple, capacitor-type motor has no commutator, slip rings, brushes or centrifugal switch — can withstand stalled current without damage.
- Taps changed with fast snap action — without shock — without brakes or sealing-in switches.

These are just a few of the many reasons for the outstanding service record of Allis-Chalmers 3-phase regulators. For complete details, call your local A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

## simple mechanism



**ALLIS-CHALMERS**

A-5462

## ELECTRICAL SYSTEMS DESIGN

**Brings you a *complete picture* of all that is best in modern practice in the design and layout of electrical systems for power, light, heat, signal systems, and communications. Shows how to select apparatus of the right type, size, appearance or rating; how to work with the architect; how to design lighting systems scientifically, etc., etc. By J. F. McPartland and Editors of Elect. Const. and Maint. 140 pp., illus., $6.00**

## PRACTICAL ELECTRICAL WIRING

**New 5th Edition. Based on 1956 National Electrical Code.** Practical methods of electrical wiring, explained in plain, easy language. Provides hundreds of on-the-job tips and short-cut suggestions. Tells how to do all kinds of light and power wiring (under 600 volts) on the farm, and in homes, factories, stores, schools, etc. **By H. P. Richter, Member, Int'l Assoc. of Elect. Inspectors. 602 pp., 468 illus., $6.75**

## MATHEMATICS FOR SCIENCE AND ENGINEERING

**JUST PUBLISHED!** A reference book planned especially to help engineers and technicians find, understand, and apply the mathematical procedures best adapted to solve a particular problem simply and quickly. Covers mathematics all the way from arithmetic to such things as complex numbers, infinite series, and methods of approximation. **By Philip L. Alger, Cons. Eng., GE. 360 pp., 117 figures, $6.95**

## HOW RATES ARE SET

***Thorough, practical guide to economic and technical factors of electric utility rate making.*** Gives fundamentals of electric utility business; discusses theoretical basis of price structure and tariff, engineering economics and cost analyses, the rate department, earnings, utility plant, depreciation, rate of return, etc. Detailed methods; many data. **Electric Utility Rate Economics. By R. E. Caywood, Mgr. of Rates, West Penn Power Co., 248 pages, illus., $10.00.**

**10 DAYS' FREE EXAMINATION**

**McGraw-Hill Book Co., Dept. EW-10-14**
**327 W. 41st St., N. Y. 36, N. Y.**

Send me book(s) checked below for 10 days' examination on approval. In 10 days I will remit for book(s) I keep, plus few cents for delivery costs, and return unwanted book(s) postpaid. We pay delivery costs if you remit with this coupon—same return privilege.

- ☐ McPartland—Elect. Systems Design, $6.00
- ☐ Richter—Pract. Elect. Wiring, $6.75
- ☐ Alger—Math. for Science Engrg., $6.95
- ☐ Caywood—Elec. Util. Rate Economics, $10.00

(PRINT)
Name .....
Address .....
City .....Zone....State.....
Company .....
Position .....
For price and terms outside U. S. write McGraw-Hill Int'l., N. Y. C. EW-10-14


## SEE Meets

(*Continued from page* 144)

and no unbalanced-voltage trouble.

But single-phase units cause greater voltage fluctuation during starting, continued Campbell. This fluctuation can be reduced economically by a series capacitor and protective gap on the single-phase transformer. Because people are apparently becoming less critical of flicker, design for 4 to 5% voltage flicker for this type of load, a maximum of four starts per hour, is believed satisfactory by some.

Aesthetic aspects of overhead construction are forcing distribution lines to the rear-property lines, said W. L. Rush, Louisiana Power & Light Co. For these locations a good distribution plan would be to run primary on side streets only, mount transformers at rear-property lines, and run secondary cable a half block in each direction. As loads grow, the transformers would be increased in size, but not in numbers, and more secondary cables would be added.

This plan proved more economical than eight others in a study of a 104-customer subdivision having a demand of 2.5 kw per home, Rush continued. Slightly more expensive were two plans using 1/0 ACSR open wire and primary on the rear-property lines. One of the latter plans had 25 and the other 35½-kva transformers.

### Would Plan Feeder Ties

Feeder ties should be planned to serve the increasingly important requirements of service continuity and convenience of operation, said J. W. Beville Jr., Florida Power & Light Co. Factors affecting feeder ties are capacity of substations and feeders and the availability of the points.

Substation capacity can be provided through use of emergency capacity of triple-rated or overloading of conventional transformers. Feeder conductors, if loaded on the basis of economics, provide sufficient emergency capacity, and voltage drop should seldom be a problem.

Installation of CSP transformers having 17-in. bushings on a 7.6/13.2-kv line subjected to heavy salt spray is expected to reduce operating problems for Gulf States Utilities Co, said A. W. Baird.

## SAVE TIME and MONEY! WITH A 6" FIELD RANGE FINDER

**. . . Widely used by 'Phone and Utility Companies**

Speed erection and maintenance of Telephone and Utility lines with this 6" Field Range Finder. Measure line clearance, spacing and sag from the ground. Measure distances from 8 ft. to 100 ft. with accuracy to within 2%. Especially useful for inaccessible objects and places. These are sturdily built instruments . . . of such compact size they're easily carried in pocket. Dependable for years of trouble-free service in rugged use. Available in two models — Direct Vision and Overhead Prism. Each supplied with a top-grain genuine leather carrying case. Order by Stock Number. (open account to rated firms).

**Stock No. 50,137-DK**
**Direct Vision Model ..... $32.50**

**Stock No. 50,138-DK**
**Overhead Prism Model ..... $43.00**

**EDMUND SCIENTIFIC CO.**
**Barrington, New Jersey**

# PROFESSIONAL SERVICES

## AMERICAN AIR SURVEYS, INC.

- Aerial Topographic Maps & Photos
- Plan & Profile for Transmission Lines
- Aerial Stereo-photos for Planning
- Topographic Maps for Reservoir Studies
- Coal Stockpile Volumes by Aerial Method

907 Penn Avenue — Pittsburgh 22, Pa.

## BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

## BLACK & VEATCH

*Consulting Engineers*

Electricity—Water—Sewage—Industry
Reports, Design, Supervision of Construction
Investigations, Valuations and Rates

1500 Meadow Lake Parkway — Kansas City 14, Mo

## THEODORE D. BROSS LINE CONSTRUCTION CORP.

Steel Tower & Wood
Transmission Lines

*Distribution & Maintenance*

175 Enfield St. — Hartford, Conn.

## BURNS and ROE, Inc.

Engineering and Design • Reports • Surveys
Construction • Electric, Steam, Hydro Plants
Transmission • Distribution • Aeronautical
Facilities • Research and Development • Nuclear, Chemical, and Industrial Plants

160 West Broadway • New York 13, N. Y.

## COMMONWEALTH SERVICES INC.

Management and
Business Consultants
300 Park Ave
New York 22, N. Y.

## ASSOCIATES INC.

Consulting and Design
Engineers
209 E. Washington
Jackson, Michigan

## DAY & ZIMMERMANN, INC.

*Engineers & Constructors*

Transmission & Distribution Lines
Substations
Design & Construction
Reports - Valuations - Rates
Industrial & Utility

New York PHILADELPHIA Chicago

## DOBLE ENGINEERING COMPANY

*Electrical Insulation Engineers*

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 20 N. Wacker Dr., Chicago, Ill.

## ELECTRICAL TESTING LABORATORIES, INC.

2 East End Ave. — New York 21, N. Y.

Electrical, Electronic, Environmental, Photometric and Chemical Laboratories. Testing, Research, Inspection and Certification.

## ENGINEERING SERVICE COMPANY MAPS

Drafting to your standards. Overhead or underground transmission and distribution maps or plats. Electric or gas.

39 W. Adams St. — Chicago 3, Ill.

## FORD, BACON & DAVIS

*Engineers*

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York • Chicago • Los Angeles

## GILBERT ASSOCIATES, INC.

*Engineers and Consultants*

DESIGN
SUPERVISION OF CONSTRUCTION
BUSINESS AND ECONOMIC RESEARCH

Reading, Pa. — New York, N. Y.

## HARZA ENGINEERING CO.

*Consulting Engineers*

Calvin V. Davis — E. Montford Fucik
Richard D. Harza

Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development

400 West Madison Street — Chicago 6

## HOOSIER ENGINEERING COMPANY

*Erection and Maintenance of Electrical Transmission and Distribution Lines*

1350 Holly Ave., Columbus 16, Ohio

## JACKSON & MORELAND, INC.

*Engineers and Consultants*

Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine Design—Technical Publications

Boston — New York

## JENSEN, BOWEN & FARRELL

*Engineers*

Appraisals—Investigations—Depreciation Studies—Cost Trends—Reports
for Rate Cases, Security Issues, Regulatory and Accounting Requirements
Original Cost and Continuing Property Record Determination

Ann Arbor, Michigan

## M. W. KELLOGG

*Piping System Design Analyses*

Unique model tester as well as modern digital computer facilities available for low cost, accurate flexibility analyses of the most complex piping systems.

The M. W. Kellogg Company
711 Third Ave., New York 17, N. Y.

## THE KULJIAN CORPORATION

*Engineers - Constructors - Consultants*

POWER PLANT SPECIALISTS
(Steam, Hydro, Diesel)
Utility • Industrial • Chemical

1200 N. Broad St., — Philadelphia 21, Pa.

## PETER F. LOFTUS CORPORATION

*Design and Consulting Engineers*

Electrical • Mechanical • Structural
Civil • Nuclear • Architectural

First National Bank Building
Pittsburgh 22, Pennsylvania

## THE LUMMUS COMPANY

*Engineers and Constructors*

385 Madison Ave., New York, N. Y.

Chicago . . Houston . . London
Paris . . The Hague . . Montreal
Caracas . . Bombay

## CHAS. T. MAIN, INC.

*Engineers*

Electric, Steam and Hydraulic Projects,
Investigations, Reports, Appraisals
Designs and Construction Supervision

80 Federal St., Boston 10, Mass.

## PIONEER SERVICE & ENGINEERING CO.

Consulting and Design
Engineers . . Purchasing
Specialists in Financing
Accounting and other Operations

231 So. La Salle St. — Chicago 4

## SANDERSON & PORTER ENGINEERS

Design
Construction

New York — New York

## SARGENT & LUNDY

*Engineers*

140 South Dearborn St.

Chicago, Ill.

## SVERDRUP & PARCEL, INC.

*Engineers - Architects*

Design, Construction Supervision
Steam and Hydro Power Plants
Power Systems - Industrial Plants
Studies - Reports

St. Louis — San Francisco — Washington

## TIPPETT & GEE

*Consulting Engineers*

Mechanical • Electrical • Thermodynamic
Structural Design • Studies • Supervision
Power Stations • Transmission • Distribution
Industrial Plants • Process

1333 North Second Street — Abilene, Texas

## F. A. TUCKER, INC.

*Contractors—Engineers*

specialize in
Distribution - Transmission - Telephone lines - Maintenance - Roads - Bridges Dams

Main Office — 38½ Center Street, Rutland, Vt.
Branch Office — Little Rock Road, Charlotte, N. C.

## UTILITIES LINE CONSTRUCTION COMPANY, INC.

*Construction and Maintenance*

Transmission - Distribution
Electric and Telephone Lines
Consultants

505 York Road — Jenkintown, Pa.

## THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

## READERS MAY CONTACT

the consultants whose cards appear on this page with the confidence justified by the offering of these special services NATIONALLY.

# SEARCHLIGHT SECTION

## ENGINEERS

### ELECTRICAL & POWER

Challenging Career Opportunities in U. S. & Latin America

ASSIGNMENTS WILL INCLUDE

A. Transmission & Distribution Engrg
B. System relaying & switchgear application.
C. Short circuit studies & calculations
D. Metering & voltage regulating problems.
E. Design of Sub, generating and switching stations.

### ELECTRICAL ENGINEER
(Senior)

Challenging opportunity for senior Relay and Systems Operation engineer with extensive electric utility experience. Must be capable of assuming heavy responsibility.

### DISTRIBUTION SUPT.
(South America)

Excellent oppty for E. E. grad to assume full supervision of operation, maintenance & construction activities of Electrical Distribution Systems in Ecuador. Must have minimum 7 years distribution experience with utility company.

If you have had experience on any of the above positions, and are interested in joining one of the leading companies in this field.

APPLY OR SEND RESUME TO
DIRECTOR OF EMPLOYMENT

**AMERICAN & FOREIGN POWER COMPANY INC & SUBSIDIARIES**

2 Rector Street, New York 6, N. Y.

## CHIEF ELECTRICAL ENGINEER

**Planning & supervision of electrical design of steam-electric stations, substations and transmission lines. Sound background and flexible personality essential for client contact. 35-50 years. Location Chicago. Long range opportunity with established, reputable engineering-construction firm. Please send confidential resume.**

P-6093, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

## ELECTRICAL ENGINEER

**Electrical Engineer interested in electrical design of power plants or industrial plants. Experience not required.**

**Excellent opportunity with consulting engineering firm in Middle West. Liberal benefit plans and good working conditions.**

**Send resume of education and experience with statement of salary requirements to:**

P-3234, Electrical World,
520 N. Michigan Ave., Chicago 11, Ill.

## LARGE POWER EQUIPMENT

*Prompt Stock Shipment*
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
*DO YOU GET OUR STOCK LIST?*
BELYEA COMPANY, INC.
51 Howell St. Jersey City, N. J.
OL. 3-3334

## SENIOR PROJECT ENGINEERS ELECTRICAL APPARATUS

**A client of ours which is a well-known midwest manufacturer of electrical apparatus is adding four men with 5-10 years' experience in one of the following: 1. High voltage lightning arresters; 2. Primary capacitors; 3. Distribution transformers; 4. Oil circuit reclosers. Age, 30 to 45. Minimum education BSEE. Compensation: Open, depending upon experience and ability. This is an exceptional opportunity for advancement with a rapidly growing company. Our client's employees know of this advertisement. Replies confidential. Send complete resume to:**

GEORGE FRY & ASSOCIATES, Dept. R
Management Consultants
135 South LaSalle Street Chicago 3, Ill.

## ELECTRICAL EQUIPMENT MANUFACTURER NEEDS

Executive Director Marketing. Age about 38. E. E. and Business Management degrees. Minimum five years successful marketing administration. Direct marketing and sales program manufacturer electrical equipment. Compensation $12,000-$19,000, plus profit incentive. Fee Paid.

QUINBY
EMPLOYMENT SERVICE
406 BANKERS MORTGAGE BLDG.
HOUSTON, TEXAS

## What is *your* problem?

**Competent men for your staff? . . . employment? . . . or are you looking for—or offering—a business opportunity of special interest to readers of this publication? You can get their attention—at small cost—through an advertisement in the Employment Section of ELECTRICAL WORLD.**

**New and Used Equipment Available for**
**POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION**
*Send for new list to*
**EBASCO SERVICES INCORPORATED**
APPARATUS EXCHANGE Two Rector St., New York 6, N. Y.

## LEGAL NOTICE

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233)
SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION

Of Electrical World published weekly at Albany, New York for October 1, 1957.

1. The names and addresses of the publisher, editor, and business manager are: Published by McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 36, N. Y.; Editor, Fischer S. Black, 330 West 42nd Street, New York 36, N. Y.; Business manager, Otto A. Dreschel, 330 West 42nd Street, New York 36, N. Y.

2. The owner is McGraw-Hill Publishing Company, Inc., 330 West 42nd St., New York 36, N. Y. Stockholders holding 1% or more of stock are Donald C. McGraw & Willard T. Chevalier, Trustees under Indenture of Trust m/b James H. McGraw, dated 1/14/21 as modified; Donald C. McGraw & Harold W. McGraw, Trustees under an Indenture of Trust m/b James H. McGraw, dated 7/1/37 as amended; Donald C. McGraw, individually; Harold W. McGraw, individually; Elizabeth M. Webster, c/o Donald C. McGraw (all of 330 West 42nd St., New York 36, N. Y.); Mildred W. McGraw, Madison, New Jersey; Grace W. Mehren, 536 Arenas St., La Jolla, Calif.; Genoy & Co., P. O. Box 491 Church St. Station, New York, N. Y.; Touchstone & Co., c/o Wellington Fund, Inc., Claymont, Delaware.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: 26,234.

McGRAW-HILL PUBLISHING COMPANY, INC.
By JOHN J. COOKE, Secretary.

Sworn to and subscribed before me this 3rd day of September, 1957.
[SEAL] JANET A. HARTWICK.
(My Commission expires March 30, 1959)

## RATE ENGINEER

**Prefer age 35-45, college graduate, electric and/or gas public utility experience. State regulatory commission experience would be helpful. Should possess ability and personality to deal with client customers. Up to $10,000, depending upon the man. Must be willing to travel. Send complete resume and photograph. Mail to: Personnel Department, Middle West Service Company, 20 North Wacker Drive, Chicago 6, Illinois.**

## U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4973) will be received at Denver, Colorado, until November 21, 1957, for furnishing Six (6) 7,750/9,687-kva, single-phase, 115 grd Y- to 11.2 delta-kilovolt, 60-cycles, class OA/FA, outdoor power transformers for Fremont Canyon Powerplant, Missouri River Basin Project, Wyoming. Delivery is desired within 500 days for first three units and 560 days for last three units. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

*REPLIES (Box No.): Address to office nearest you c/o This publication Classified Adv. Div.*
*NEW YORK: P. O. Box 12 (36)*
*CHICAGO: 520 N. Michigan Ave. (11)*
*SAN FRANCISCO: 68 Post St. (4)*

### *POSITION VACANT*

**Position Available: Middle Atlantic State.** Graduate Electrical Engineer as Superintendent with intimate knowledge of Generation. Distribution, and Metering. Municipal, 20,000 pop. Steam. Furnish resume and salary requirement. P-5989, Electrical World.

### *SELLING OPPORTUNITY OFFERED*

**Electric Power Products for Southeast marketing** to supplement two existing lines now being made and sold to Public Utilities. Experienced, aggressive field sales staff with exceptional contacts will assure sales. Complete manufacturing facilities available for patented or patentable items if so desired. RW-6311, Electrical World.

**DON'T FORGET**

the box number when answering advertisements. It is the only way we can identify the advertiser to whom you are writing.

# Advertising in This Issue


Advertising Council, Inc. ..... 156
Allis-Chalmers Mfg. Co. .....8, 9, 151
Aluminum Co. of America .....68, 69
American Chain & Cable Co., Inc., Page Fence Ass'n. ..... 149
Anaconda Wire & Cable Co. ..... 33

Bakelite Co., Div. Union Carbide Corp. ..... 60
Baldwin-Lima-Hamilton Corp., Eddystone Div. ..... 34
Baltimore & Ohio Railroad ..... 52
Bell Telephone Laboratories ..... 47
Blackburn Corp., Jasper ..... 58
Brewer-Titchener Corp. ..... 120
Bussmann Mfg. Co. .....102, 103

Cable Spinning Equipment Co. ..... 142
Chance Co., A. B. ....137, 138, 139, 140
Colorado Fuel & Iron Corp., Wickwire Spencer Steel Div. ..... 65
Continental-Diamond Fibre Sub. Budd Company ..... 26
Cornell-Dubilier Electric Corp. .... 128, 129

Directory of Engineers ..... 153

Eastern Specialty Co. ..... 108
Edmund Scientific Co. ..... 152
Electrical World ..... 125
Electric Service Works, Delta-Star Electric Division, H. K. Porter Company, Inc. .....113, 114, 115, 116, 132
Electromode Div., Commercial Controls Corp. ..... 143
Engineers, Directory of ..... 153
Exide Industrial Div., The Electric Storage Battery Co. .....3rd Cover

Fanner Mfg. Co. ..... 124
Federal Pacific Electric Co. ..122, 123
Foushee & Heckendorn ..... 149

General Cable Corp. ..... 51
General Electric Co. Apparatus Dept. ..39, 40, 53, 71, 93, 94, 95, 96, 98, 99, 101, 155
Goodrich Chemical Co., B. F. ..... 6
Guaranty Trust Co. of N. Y. ..... 37

Highway Trailer Co. ..... 66
Hubbard & Company ..... 105

I-T-E Circuit Breaker Co., Switchgear Div. .....106, 107
Indiana Steel & Wire Co., Inc. .... 118

Jenkins Bros. ..... 36
Johns-Manville ..... 42
Joslyn Mfg. & Supply Co. ..... 43

Kaiser Aluminum & Chemical Sales, Inc. .....12, 13
Kearney Corp., James R. ..... 50
Kerite Company, The ..... 72
Kuhlman Electric Co. .....4th Cover

Lapp Insulator Co., Inc. ..... 46
Line Material Industries ..27, 28, 29, 30, 31

McCabe-Powers Auto Body Co. .. 7
McGraw-Hill Book Co. ..... 152
Meter Devices Co. ..... 152
Monsanto Chemical Co. ..... 41

National Telephone Supply Co. .... 70

O. Z. Electrical Mfg. Co., Inc. ..130, 131
Ohio Brass Co. ..... 23
Okonite Co., The ..... 4

Page Fence Ass'n., American Chain & Cable Co., Inc. ..... 149
Palnut Company ..... 148
Pennsylvania Transformer Div., McGraw-Edison Co. .....48, 49
Phelps Dodge Copper Products Corp. .....44, 45
Preformed Line Products Co. .... 56

RT&E Corp. ..... 15
Richardson-Allen Corp. .....54, 55
Rockbestos Products Corp. ..... 109

S&C Electric Co. ..... 18
Sangamo Electric Co. .....10, 11, 57
Searchlight Section ..... 154
Smith Co., S. Morgan ..... 14
Socony Mobil Oil Co., Inc. ..... 32
Southern States Equipment Corp. . 67
Square D Co. ..... 35
Superior Switchboard & Devices Co. ..... 144

Texas Company, The .....2nd Cover
Thomas & Betts Co., Inc. ..... 38

Union Carbide Corp., Bakelite Co. Div. ..... 60
United States Steel Corp., American Steel & Wire Div. .24, 25
Coal Chemical Sales Div. ..126, 127

Westinghouse Electric Corp. ..16, 17, 61, 62, 63, 64, 110, 111, 121, 147
Wheeler Reflector Co. ..... 59
Whirlpool Corporation ..... 119
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp. ... 65


■


PROFESSIONAL SERVICES ..... 153


■

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.


EMPLOYMENT OPPORTUNITIES ..... 154

EQUIPMENT
(Used or Surplus New)
For Sale ..... 154



GET RELIABLE CAPACITOR SWITCHING AT LOW COST

This General Electric heavy-duty time switch provides reliable low-cost control for capacitor switching. Dependability and long service life mean you save on maintenance costs, too. These features of the TSA-40 time switch make it an outstanding buy:

- Exclusive contact shearing action breaks welds and keeps contacts clean.
- Completely rain-tight case gives protection in all climates.
- Extended temperature range allows operation in temperatures from −50 to 150° F.
- More wiring space and removable cover simplify installation and maintenance.
- Off-the-shelf delivery means you can get the TSA-40 *when you need it.*

**Contact your local G-E time switch distributor or send for free bulletins listed below today!**

GENERAL ELECTRIC

SECTION B384-15
GENERAL ELECTRIC CO.
SCHENECTADY 5, N. Y.

☐ Please send me free bulletin GEA-6468A on the TSA-40 time switch.

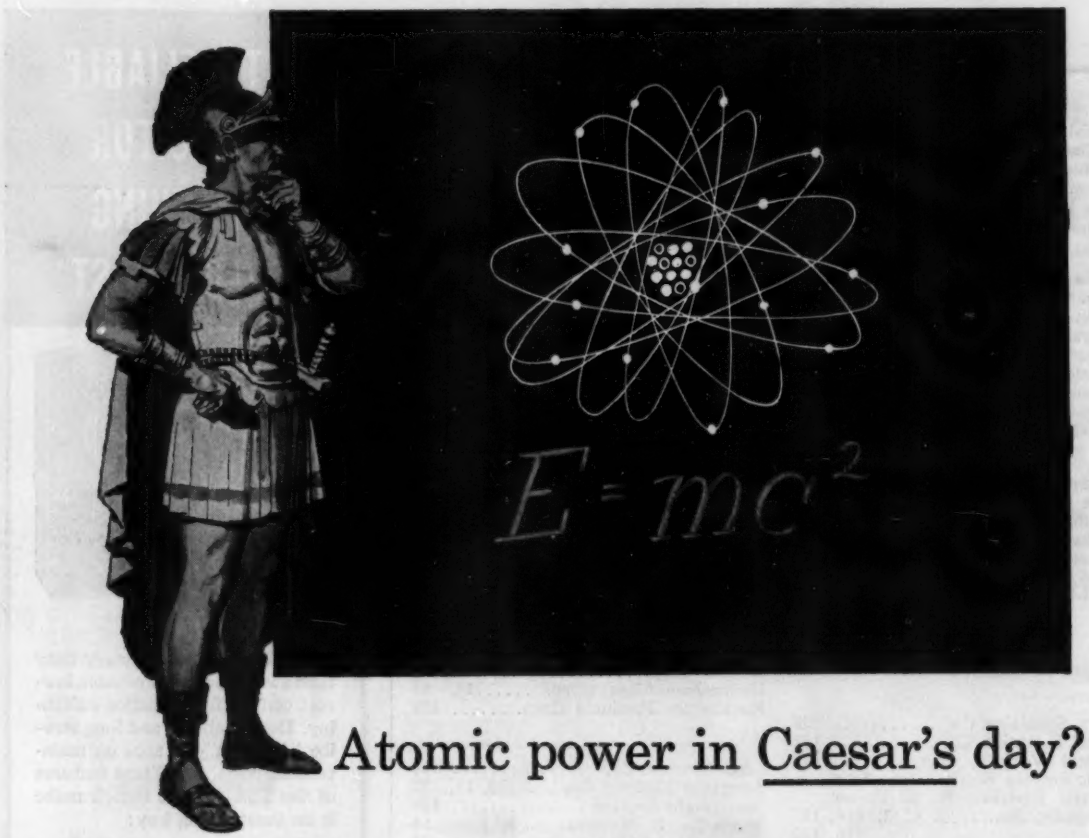
☐ Please send me free bulletin GEA-6681 on complete TSA time switch line.

NAME.....

POSITION.....

STREET.....

CITY..... STATE.....




# Atomic power in Caesar's day?

## *Certainly!*

It was there, in the ground, in the air and water. It always had been. There are no more "raw materials" today than there were when Rome ruled the world.

The only thing new is knowledge . . . knowledge of how to get at and rearrange raw materials. Every invention of modern times was "available" to Rameses, Caesar, Charlemagne.

In this sense, then, we have available *today* in existing raw materials the inventions that can make our lives longer, happier, and inconceivably easier. We need only *knowledge* to bring them into reality.

Could there possibly be a better argument for the strengthening of our *sources* of knowledge—our colleges and universities? Can we possibly deny that the welfare, progress—indeed the very *fate*—of our nation depends on the quality of knowledge generated and transmitted by these institutions of higher learning?

It is almost unbelievable that a society such as ours, which has profited so vastly from an accelerated accumulation of knowledge, should allow anything to threaten the wellsprings of our learning.

## *Yet this is the case*

The crisis that confronts our colleges today threatens to weaken seriously their ability to produce the kind of graduates who can assimilate and carry forward our rich heritage of learning.

The crisis is composed of several elements: a salary scale that is driving away from teaching the kind of mind *most qualified* to teach; overcrowded classrooms; and a mounting pressure for enrollment that will *double* by 1967.

In a very real sense our personal and national progress depends on our colleges. They *must* have our aid.

Help the colleges or universities of your choice. Help them plan for stronger faculties and expansion. The returns will be greater than you think.

If you want to know what the college crisis means to you, write for a free booklet to: HIGHER EDUCATION, Box 36, Times Square Station, New York 36, New York.

HIGHER EDUCATION

KEEP IT BRIGHT

PUBLIC SERVICE ADVERTISING COUNCIL

*Sponsored as a public service, in cooperation with the Council for Financial Aid to Education*

*Being interviewed is W. C. Dunn, Supervisor of Industrial Laboratories*

## "We've been waiting 21 years for this battery to wear out"

*At the Exide Laboratories*—**Reporter:** Has this battery been on test all that time, Mr. Dunn?

**Dunn:** Yes, it's been subjected to a continuous float life test typical of the kind of use it would get in most applications. And you can see for yourself just how little sediment there is on the bottom of the jar.

**Reporter:** What does that indicate?

**Dunn:** It means that most of the active material is still locked in the spiral lead buttons unique with Exide-Manchex Batteries.

**Reporter:** Do today's Exide-Manchex Batteries have the same long life potential?

**Dunn:** Even better. Because the batteries made today incorporate significant improvements in materials and construction that assure even greater length of service and better performance than these batteries were ever capable of before.

**Reporter:** What do these advantages mean to battery users?

**Dunn:** Greater economy and more dependability—the two qualities that have made Exide-Manchex Batteries world famous for years.

**Note to battery users:** Whenever you order batteries for float or cycle service in stationary applications, be sure to specify Exide-Manchex. Write for detailed bulletin. Exide Industrial Division, The Electric Storage Battery Company, Phila. 2, Pa.

THE ELECTRIC STORAGE BATTERY COMPANY **Exide**®

KUHLMAN "Salesman of the Week"

If you can identify this Kuhlman representative, and are the first one to notify Dept. SA-1, Kuhlman Electric Co., Bay City, Mich., you will receive a valuable gift.

# "Meet the people who make Kuhlman transformers"

"The gentleman at the extreme right is John Franklin, our Bay City factory superintendent. John's been building transformers nearly all his life. He has been with the company more than 40 years.

"Next to John is Cliff Lefler, President of our "Quarter Century" Club. Cliff tells me that the club's membership now represents more than 7% of our employment.

"In fact, 50% of our people have been with the company more than 10 years—over 25% more than 15 years!

"Low labor turn-over . . . years of on-the-job experience . . . quality craftsmanship have been our "way of life" since 1894. You'll find us the kind of company you'll enjoy doing business with. Ask anyone of our thousands of satisfied customers."

5718A

**KUHLMAN ELECTRIC COMPANY**

GENERAL OFFICES: Birmingham, Michigan

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA